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ENGINEERING AND MINING JOURNAL-PRESS

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Marketing Crude Petroleum

An Account of How the Business Is Conducted from Well to Refinery

By L. M. Fanning

Formerly Director of Publicity and Statistics, American Petroleum Institute

The marketing of California's flush production of petroleum in the last two years made it difficult for many producers in other sections to continue.

Experiments in Cobalt-Silver-Nickel Smelting
By A. Carr Harris

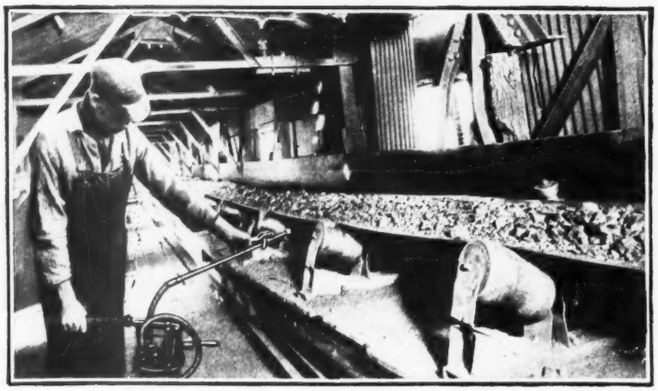
A New Copper District Near Salmon, Idaho
By Clyde P. Ross

Mills of the San Juan, Colorado

Useful Operating Ideas

Situation at the Mines

Metal Statistics



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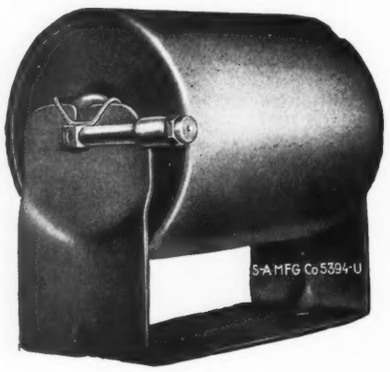

ENGINEERING AND
MINING JOURNAL-PRESS

JOSIAH EDWARD SPURR, Editor

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Bolshevism and Official Inaction in Mexico

GENERAL REGRET will be felt at the official inaction that followed the murder of Charles Ferris Sturtevant, a mine superintendent, at Mocorito, Sinaloa, Mexico, on June 4 last, particularly because Mr. Sturtevant was a man of unusual character, and valued by the company for his integrity and for the justice and consideration with which he treated the Mexican employees. The circumstances leading up to the attack that ended the life of an experienced mining engineer have been duplicated many times in Mexico, the victim invariably failing to grasp the seriousness of the situation and failing to realize the inadequacy of the local courts. In a letter to Mrs. Sturtevant, which was dated May 27, Mr. Sturtevant described an experience he had just had with one of the workmen at the mine who had been laid off. He wrote:

"Well, something did happen today. Last night I laid off two of my machine men for sleeping and rotten work. Tonight, when I went up to the mine a little after 4 o'clock as usual, one of them, Ramon Cuadras, met me just at the turn in the track where you can see neither the mine nor the mill. He demanded to be put back to work, and then pulled out a big knife and stuck it against my belly, calling me all the Gringo pet names he could think of, and said he was going to kill me right then and there, anyway. I got quite busy with my Spanish vocabulary and parleyed with him about five minutes, ending up by telling him to come out in the morning at his old job. He told me if I said a word about this meeting he would kill me sure. Like a damned fool he let me go. I went on over to the mine, started the shift and told Chico I wouldn't go down just at present but would come back later. Then I came back to the hacienda, got Chon and Cad, and told them about it. Chon immediately went up town and found the fellow boozing. He covered him with his automatic and made him disgorge his knives and pistol, then told him to come along. Chon took him to Mocorito and he is now in jail there. It will probably go pretty hard with him, and I hope he gets no less than two years. He will get me if he gets the chance. There are two other fellows in the mine that I have to get rid of—like this fellow, Bolshevists, and have it in for anybody in authority."

Mexican "justice" miscarried, however, and the miscreant was given his liberty after the payment of a nominal fine and three or four days in jail. On June 2 a protest was lodged with the Presidente at Mocorito by company officials. On June 4 Sturtevant left the office at 4 p.m. to place the men for the afternoon shift. At 4:30 the manager was informed that he had been killed. The body, riddled with bullets, was found on the floor of a short tunnel connecting the patio and an open-cut. Evidence showed that the assassin had hidden himself in a drift leading from the tunnel in which the body was found, from which there are several exits to the surface. The authorities were notified, but without tangible result to date. We commend the incident to the attention of the U. S. Department of State at Washington. Sturtevant was an American citizen.

Returning to Gold and Silver

NUMEROUS REPORTS that have appeared in the London press for many week indicate a strong desire on the part of Great Britain to return to the gold standard and to again establish an open gold market. Discussion has been going on as to how this desirable object can be brought about most quickly and satisfactorily. Some English economists have been trusting to an increase in the general price level of the United States as an influence which would bring sterling back to par. This presupposes, of course, that the British price level would remain stationary while the increase in the United States was proceeding. Other observers do not anticipate a rise in the price level here and do not delude themselves into thinking that an advance must inevitably occur through force of the huge accumulation of gold in the United States. Their method of restoring the pound sterling to normal involves artificial expedients—mainly an increase in the bank rate in London. This step would naturally be taken reluctantly, because the trend of interest rates—in the United States at any rate—is downward. At the moment money is cheaper in New York than in London, and it is well known that London's pre-eminence in the financial world is owing largely to the relatively low rates at which funds generally can be obtained there.

Regardless of what effort will be made by England to restore the gold standard, it is significant to note that the will to make the effort seems to be increasing constantly in strength. A few years ago many prominent British bankers despaired of ever returning to the old rate for the pound sterling and urged the establishment of a new parity. This solution is no longer voiced. Great Britain doubtless realizes that she cannot regain her position of financial leadership in the world unless she stands squarely upon a gold standard. British banking enterprise secured a signal victory some months ago in persuading the Germans to use the pound sterling (paper) as the unit for the reserves of the new gold bank then organized. Probably the compelling argument in that case was the fact that the German bankers would benefit greatly by any improvement in sterling exchange.

With the United States and Great Britain on the gold standard the prospect of other nations coming into the fold again becomes bright indeed. As a matter of fact the smaller states are on the way and seem to be using silver as a stepping stone to reach the gold basis. We have already chronicled how Poland will use large amounts of silver for circulation in her borders. Recently Poland purchased another 3,000,000 oz. of American silver, making 6,000,000 oz. in all, for coinage.

The return to gold should be received with much satisfaction. It shows that the efforts of those persons who would discredit the gold standard and discourage its use as money have not made much headway. Fortunately, all the schemes that have been advanced by

those who prefer some other standard to gold have been readily seen to be impracticable and often worse than the disease which they profess to cure. The lesson of the paper debauch of the last seven years is still too fresh in memory to encourage experimentation with untried economic monetary theories. Even Germany, with her latest currency expedient, the rentenmark, is fearful of its success, although it, at least, is based upon something no less tangible than real estate. However, real estate cannot be transported as can the precious metals, and therein lies the secret of the esteem in which gold and silver are held. Both metals represent concentrated wealth whose value is not likely to change suddenly and sharply. They have been tested by time, and, although discarded generally during and after the war, the countries of the earth will turn back to them with open arms.

The Demon Statistician

ACCORDING to *The Statist*, of London, "it is believed that, if German reparations are adjusted immediately along the lines of the Dawes report, the European consumption of copper will quickly increase fully 223,250 tons a year beyond the present total." The man that wrote that must know what he is talking about, but even assuming that the increase will not be more than 223,248 tons, this should certainly help in restoring prosperity to American copper producers. What they are waiting with bated breath to hear, however, is whether these are short, long, metric, or maybe assay tons.

Psychology and Vanadium Drill Steel

STRANGELY enough, two years of constant effort on the part of the management was required to introduce vanadium drill steel in the underground operations of a large lead-mining company in the West. The officials long ago were convinced of the economy of using alloy steel, and the results have proved the soundness of their contention. Why, then, did they experience difficulty in making a change from the old steel? The trouble lay largely in the attitude of the workers: the miners themselves, but more particularly the men who sharpen steel in the shop. A miner is in many ways a conservative; when he is getting along well enough he dislikes innovations. It was found that in large-scale tests it was necessary to take all the old steel off a level and supply the vanadium steel exclusively, or the miners would steer clear of the "new stuff" and find some excuse for using the carbon steel.

The drill sharpeners had a more valid reason for their prejudice against the vanadium steel. The tempering of a bit of alloy steel is a more delicate operation than tempering one of ordinary steel. The range of temperature is not so wide. Greater care is required to keep the steel from becoming too brittle. But it can be done. It was found that oil-fired furnaces were essential because of the ease with which temperatures can be regulated. Pyrometers were installed on the furnaces at the outset, but as soon as the sharpeners became thoroughly familiar with the operation they were able to determine the proper temperature by the behavior of the steel, and they voluntarily dispensed with the pyrometers. Now that they have learned to manipulate the vanadium steel properly, now that they are "sold" on the idea, the sharpeners are able to do the forging and tempering as successfully and as easily as they formerly could with the old steel.

Three advantages of the vanadium bit are obvious: It holds its edge longer; it holds its gage better; it cuts faster. One of the biggest advantages is that the breakage is less than with ordinary steel. This is a point with which some will take issue. If the tempering is not properly done, the alloy drills will break; but if it is properly done they are much tougher than the others. In the particular mine that we are discussing it has become necessary to cut up new bar steel to make starters! In nine mines out of ten there is, as a consequence of constant breakage, a surplus rather than a shortage of short steel.

The biggest factor in the cost of drill steel at the face where it is used is the sharpening and the collection, transportation, and distribution of dull and sharp bits. If this can be cut down by 25 per cent as a consequence of longer effective life—it never pays to use any kind of drill when it is in bad condition—any small difference in first cost is unimportant. Hollow round vanadium steel costs about 17c. per pound; carbon steel costs 14c.

To say that every mine could save money by using vanadium steel would be too broad a statement. At the same time, at least four big Western mines in four different states are using it with marked advantage. We know also of places where, after more or less thorough tests, the idea of using alloy steel has been abandoned. It is possible that more persistent experiment would have changed the decision. At any rate any manager who wants to give it a trial may profit by the experience that we have related.

It is seldom that any innovation—drill steel or anything else—will succeed around a mine unless the men who actually do the work are in favor of the new plan, or at least are open-minded in their attitude. The psychology of the miner is a factor not to be overlooked.

Carbonaceous Matter and Metallic Ores

THE OCCURRENCE of carbonaceous matter in ores is a subject of great interest, both to the metallurgist and the geologist; and although they approach the subject from entirely different viewpoints, their investigations meet on the common ground of making the results serve the mining industry. Also, sometimes the one hand washes the other, as in the determination of Mr. André Dorfman at Porcupine, that the "graphite" which occurs in that camp along certain slips is not graphite but amorphous carbon—a clew of importance to the geologist. The occurrence of carbon in Porcupine has recently been the subject of several papers and of some discussion in the Bulletin of the Institution of Mining and Metallurgy (London).

The subject is indeed a far-reaching one; perusal of the reports of the Geological Survey of Canada indicates that carbonaceous and graphitic material is far from uncommon in connection with the mineral veins of the dominion—especially, it might seem, with gold-quartz veins. This material, however, is also associated with other ores, as with the silver ores which were mined at Silver Islet, in Lake Superior, a fact which Mr. Walter McDermott recalled in the discussion mentioned above.

Nor, of course, is the association of carbon with ore deposits peculiar to Canada. The sulphide deposits of Ducktown, in Tennessee, contain graphite. In south-

western Missouri there is much carbonaceous matter associated with the lead and zinc ores, and in the Miami (Oklahoma) zinc field, bitumen is very abundant in association with the ores. Quicksilver ores in general are frequently accompanied by bituminous or carbonaceous material, in such widely separated regions as California, Peru, and Jugoslavia. Vanadium ores also are often strikingly associated with hydrocarbons, as in Peru and elsewhere.

Whoever undertakes to explain offhand and empirically the association of carbon in its various forms and of various hydrocarbons with ore deposits will make a great mistake in doing so. This problem is one concerning which our absolute knowledge is exceedingly slight; it is a geological and chemical question, concerning which explanations are little more than guesses. On the one hand, the contemplation of bituminous matter and asphalt in connection with ore leads us in thought to the commonest of hydrocarbons, petroleum, concerning which an organic origin is generally assumed or admitted; and the tendency is to carry the explanation of organic origin back over the bituminous matter and asphaltites, through the carbonaceous shales to the graphitic shales, and to other forms of graphite, and even to the crystallized carbon which we call diamond. To be sure, the graphite which occurs as a primary mineral in certain pegmatites gives us temporary pause in this course; and when we consider the diamond, which occurs chiefly in peridotitic necks, we pause again. The severest test for us, however, is the occurrence of diamonds in meteorites. We decide now that somewhere in the pursuit of the carbon problem, starting with petroleum and speeding through to graphite and the diamond, we have probably slipped our trolley, as the colloquial phrase puts it—we have switched to the wrong track. But at what point did we get off? Shall we assume a dual origin for carbon and the hydrocarbons—organic and non-organic—or may we assume that they are all either one or the other? Shall we admit that petroleum may be non-organic, as some believe; or shall we assume, as many do, the organic origin of all, even of diamonds? The latter assumption involves such startling conclusions as to the wide spread of organic life in the universe, that we recoil from it, dizzy with the conception of so much life whirling through space, on orbs ultimately smashed and scattered in fragments throughout the eternal and endless voids.

Returning to our starting point, the carbon veins or "slips" of Porcupine, it is difficult to admit in this case an organic origin. The carbon came up and was deposited along certain fault fissures at a definite period of time, sharply defined with relation to the other geologic events, almost—or quite—as if it were a stage of the magmatic sequence. It is by no means proved that it was such, but it has that appearance. The rocks which inclose the carbon veins are the Keewatin schists and later intrusives. The Keewatin rocks are old volcanics, and are earliest known rocks. No life accompanied them or preceded them, so far as we know. It has always been believed that these were truly the Azoic rocks—the records of a lifeless era.

The discussion simmers down to the fact that we are in the presence of an unsolved problem—one that awaits careful study and research and a clear and balanced presentation of the facts which are available and those which remain to be unearthed. It is the most likely hypothesis that carbon and the hydrocarbons have a dual origin, and this may perhaps extend clear through to petroleum on the one end and the graphites and diamond on the other. Petroleum has been found in the vesicles of basaltic rocks on recent volcanoes. On the other hand, graphitic schists have a most appealing and plausible putative lineage back through carbonaceous shales to plant and vegetable life. But the carbons and hydrocarbons associated with pegmatites and with mineral veins have been deposited from solution, and in most cases from magmatic solutions. There is no doubt about that. The question is where the magma picked up the carbon and the hydrocarbons; whether they came from the depths of the earth and are of telluric origin, or were distilled out of the rocks traversed by the magma and picked up by the magma in its upward penetrating course; or whether both explanations are true, in different cases. And this last is the most likely working hypothesis.

Miners Are Saving Money

THE WAGE-EARNERS in some of the copper camps seem to be making and saving money, even though the companies for which they work do not find the times particularly prosperous. We have just been looking over a statement of United States postal savings deposits in the various cities of the country, and we find that the total decreased during June, but in most all of the mining towns an increase in deposits is reported. The inhabitants of Butte, particularly, seem to have a good stock of bones in the cupboard, postal savings there amounting to $748,000 and ranking seventeenth among the cities of the country, and above those of San Francisco, Milwaukee, Cincinnati, Cleveland, and other prominent cities. No. 21 on the list is Great Falls, Mont.; and Ironwood, Mich., and Leadville, Colo., are not far behind.

Mexico's Recent Gold and Silver Legislation

ACCORDING TO ADVICES from Mexico, silver is at a discount there owing to its great abundance, or, in other words, gold is at a premium, being relatively much more scarce. To remove this premium on gold, the Mexican Government passed a decree several weeks ago requiring the importation of gold equivalent in value to that contained in exported ores or bullion—a virtual embargo on the export of gold from Mexico. Added to this, and a more onerous provision, was a decree requiring silver miners to import one-quarter of the value of the silver exported from Mexico in the form of gold. Vehement protests from miners caused this legislation to be suspended.

Unlike European countries, Mexico is on a hard money basis, but evidently she, too, has her currency troubles. Compared with those abroad, however, the difficulties seem mild indeed. In fact, they can be ironed out without the drastic legislation contemplated by the Mexican Government, which would have been especially trying to one of Mexico's greatest industries, silver mining. The natural action of economic forces will straighten out the trouble far more satisfactorily than artificial expedients. Should the premium on gold continue, someone sometime will find it profitable to ship gold to Mexico and exchange it for silver or other commodities which may be selling at a discount compared with gold. The Mexican Government acted wisely in suspending its decrees.

Metallurgists of Note

Edwin Letts Oliver

INVENTIVE INITIATIVE in the application of the cyanide process, particularly in regard to the solution of the mechanical problem of dewatering and filtering finely divided and colloidal material, has had a powerful influence on the successful advance of scientific and technical control in other branches of industry. Few engineers can claim the credit of invention of wide applicability — of having contributed, as Edwin Letts Oliver has done, something fundamentally novel in the automatic separation of solids from liquids. Born in San Francisco in 1878, and graduated from the University of California in 1900, Oliver in 1903 became associated with the North Star Mines Co., at Grass Valley, Calif., first as surveyor and later as metallurgist. This contact with practical work suggested an avenue of worth-while research and provided an opportunity to design and develop the rotary drum filter, the first really successful continuous machine of its type to use a vacuum, and one that has since found wide application in metallurgical, chemical and general industrial fields. Financial realization of the results of inventiveness involves the commercialization of the idea and close personal contact with development and application. Thus it became necessary for Oliver, soon after the basic patent was granted in 1909, to combine business and technology—not only for the purpose of exploiting the machine but to adapt it to the varied requirements of the increasing applications of science to industry. The present company was not incorporated until 1922. The parent concern was known as the Oliver Manufacturing Co., and the reorganization was effected along unusual lines: Oliver bought out the moiety of stock in other hands, and assigned patents and good will to a new corporation, now well known as the Oliver Continuous Filter Co. As president and general manager of this, he has guided the venture into newer and still newer fields of endeavor with conspicuous success, until the original purpose of the machine may be said to have become of secondary importance. It is interesting to note, in these days of industrial co-operation, that an opportunity offered to employees in 1923 to purchase stock was taken advantage of by over 80 per cent of the technical, office, and factory forces. The efficient handling of the slime that resulted from the crushing of metalliferous ores in the early days of the cyanide process involved a consideration of three important desiderata—cheapness, continuity, and automaticity. It was the combination of these in the Oliver filter that attracted worldwide attention to the work initiated at Grass Valley in the development of a machine that, in addition to numerous direct uses, may be said to have solved the problem of the efficient treatment of gold and silver ore by continuous counter-current decantation, by reducing the final loss of precious metal to reasonable limits. Its use as a dewaterer of flotation or other types of concentrates is well known; more recently it has found application in deep mines, to remove from water to be pumped the fine abrasive sand and slime formed during drilling. To enumerate the applications of the Oliver filter in chemical technology would necessitate a fairly comprehensive survey of technical progress in recent years. Engineers who contribute an idea or a composite of ideas to their profession in the form of process or apparatus are to a considerable extent liable for the ultimate outcome. Experience has shown that failure to protect by patent leads to engineering plagiarism, to experimental modification along impracticable if not absurd lines by others unacquainted with the ideas of the original inventor, and to a lack of technical progress in consequence of the attitude of sceptics, who invariably "look a gift horse in the mouth." To protect an invention and assure its use in the interest of industrial economy and efficiency connotes activity in a branch of professional endeavor that, when associated with the observance of a high standard of ethics, constitutes a necessary foundation for the technical success of the industry as a whole. And the name of Edwin Letts Oliver ranks high among metallurgists in this class. He is a member of the Institute, the Mining & Metallurgical Society of America and the Chemical, Metallurgical & Mining Society of South Africa.

EDWIN LETTS OLIVER

A New Copper District Near Salmon, Idaho*

Geological Features Show This Area To Be a Promising One for Prospectors

By Clyde P. Ross
Geologist, U. S. Geological Survey

Clyde P. Ross

MINING activity has increased notably in various parts of Idaho during the past year, and the developments in the new copper district near Salmon, Lemhi County, are among the most interesting phases of the reawakening. I spent two weeks in the summer of 1923 in an examination of these deposits for the U. S. Geological Survey and the Idaho Bureau of Mines and Geology. An official report on the result of the examination is in preparation, and this paper is intended merely to summarize the more important results and to make them available to those interested in mining and prospecting. The data obtained in this examination show that there are in the vicinity of Salmon a number of copper deposits which have as yet not been extensively developed but in which there are orebodies of moderate size and grade associated with certain geologic structures. The average ore can be satisfactorily concentrated by simple means, and contains none of the substances deleterious to smelting in appreciable amount.

Production Has Been Small

The existence of copper deposits in this vicinity has been known since 1856, but little has been done with them until recent years. With the decline in mining for gold, silver, lead, and minor metals in the county, interest in the copper deposits has increased. Most of the copper mined prior to 1911 was obtained incidentally in mining for other metals, principally gold, and none of the copper mines made regular shipments before 1918. From 1911 to 1922, inclusive, according to the records of the U. S. Geological Survey, 22,306 tons of copper ore containing 1,685,230 lb. of copper, 1,028 oz. of gold, and 7,546 oz. of silver has been shipped from Lemhi County. At present the Harmony and Pope-Shenon mines are shipping concentrates steadily, two other properties are being developed, and there are also several prospects.

Mining Conditions Favorable

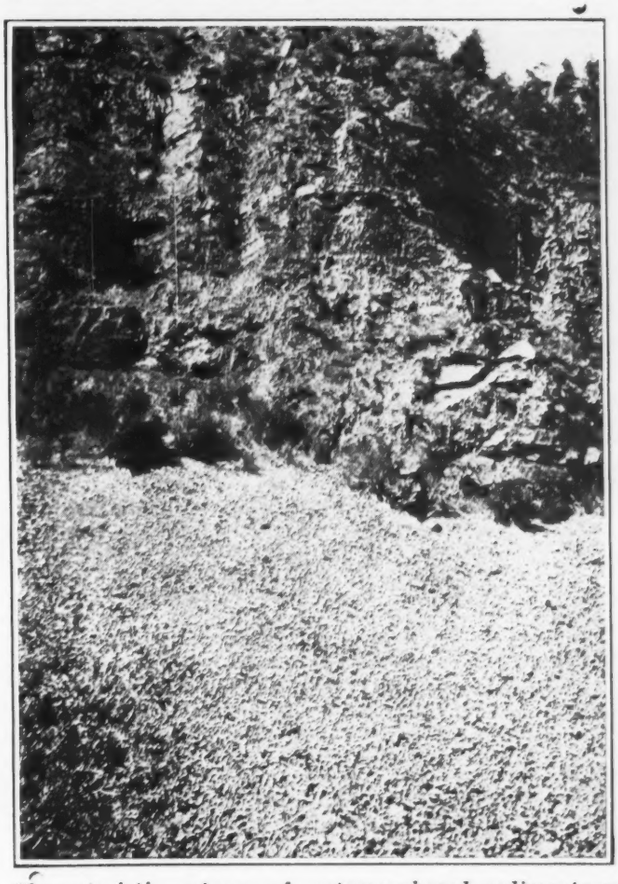
The district is served by the Pittsburgh and Gilmore R.R., a line 100 miles long connecting with the U.P.R. at Armstead, Mont. Transportation costs are high, but not excessively so. Wagon roads have been built or can be built to reach millsites near all the known deposits, and the distance to a main highway is in every case under ten miles. From the junction with a highway to a station on the railroad is only a few miles farther.

As most of the deposits crop out high up on steep mountain sides, they are developed by means of tunnels, with consequent convenience and economy in underground haulage, and aërial tramways are used to transport ore to mills at convenient sites near the streams. On the other hand, transportation of supplies and men up the slopes to the mine is slow and laborious.

The rock is hard, but not excessively so. Large amounts of timber are not required, and many tunnels stand well without any. Timber for mine purposes can be obtained from local sawmills.

Miners are recruited largely from the farming population of the Lemhi and Salmon River valleys. The men are industrious, and many of them are experienced miners. The number available is adequate for present needs except during busy farming seasons.

The copper deposits examined are all in dark green, gray, and black quartzitic argillite and micaceous quartzite. Above these, probably uncomformably, are Ordovician and later Paleozoic strata, but these are



Characteristic outcrop of metamorphosed sedimentary rocks with talus slope below, on Withington Creek near the Harmony mine

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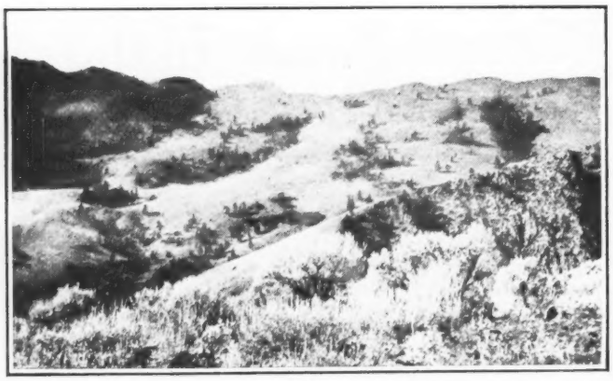
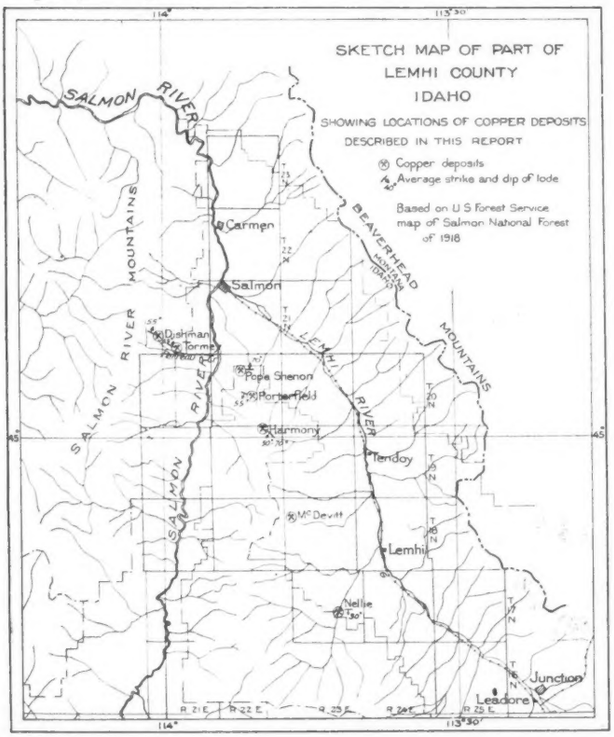


The rolling country above the gorge of Perreau Creek. Taken from near the Torney mine

scantily represented in the vicinity of the deposits. Tertiary lava and associated pyroclastics line the flanks of the mountains and lap up on them. In the foothills and underlying the valleys of Salmon and Lemhi rivers are indurated clastic deposits believed to be of Miocene age. These are known as "lake beds," although a considerable part are not strictly lacustrine deposits. There is aluvium of Quaternary age along the streams, especially Salmon and Lemhi rivers, and the gently sloping parts of the surface of the "lake beds" are covered by a layer of unconsolidated gravel.

A few miles northwest of the most northerly deposit examined is an extensive mass of granite with associated dikes cutting the metamorphic rocks surrounding it. To the south, near the head of Lemhi River, there are smaller masses of quartz diorite. All these masses are probably related in age and genesis to the great batholithic masses of granitic rocks in central Idaho, which are believed to have been intruded at about the close of the Cretaceous.

For a more extended description of the stratigraphy of the rocks of Lemhi County the reader is referred to Umpleby's[1] report, which also describes other deposits.



The metamorphic rocks were bent into broad folds with northerly trends at some time early in their history. These and the younger rocks are affected by flexures or fractures with northwesterly trends and others of somewhat less magnitude with northeasterly trends. Both of these appear to have originated at about the same time as the batholithic intrusions to the west and the great overthrusts to the east and southeast. That is, they were formed at the end of the Cretaceous or beginning of the Tertiary. Besides the structural features mentioned above there are numerous minor folds and faults in the Tertiary rocks.

All the copper deposits examined are shear zones in quartzitic rocks in which mineralization has been effected largely by metasomatic replacement but in part by filling of fissures within the shear zones. The minerals of the lodes comprise quartz, various micas, chlorite, epidote, chalcopyrite, magnetite, specularite, very small amounts of sphalerite, secondary chalcocite, and in exposed parts of the lodes such oxidized minerals as malachite, azurite, cuprite, and a little native copper. Bornite is an important primary ore mineral at the Nellie prospect, but is rare in the other deposits examined. Delafossite and barite were noted at the Pope-Shenon mine only.

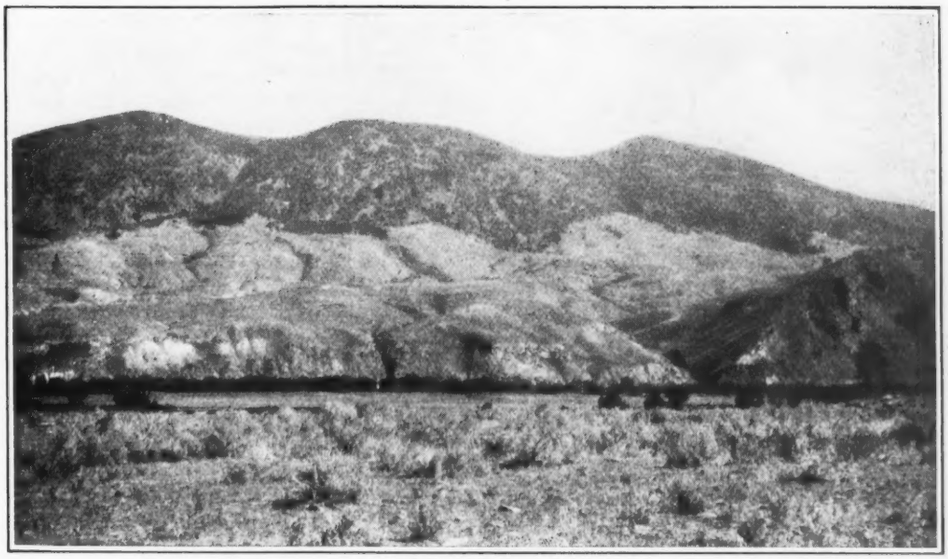
Character of the Occurrences

The lodes, in general, are steeply inclined and roughly tabular masses of sheared and somewhat altered country rock from a few inches to twenty feet or more wide, in which there are shoots containing sufficient quantities of copper minerals to be mined as ore. They do not, like veins filling single fissures, have definite foot and hanging walls throughout their lengths. In places the zones as exposed underground are bounded on one side or both sides by fairly smooth rock faces showing evidence of movement along them, but it is by no means certain that these mark the actual limits of the deposits. Indeed, it is probable that some of them are post-mineral slips, and bear no direct relation to the extent of the original deposits. At two places on the property of the Harmony Mines Co. there are pairs of lodes coming together at small angles. These appear to have resulted from the splitting of shear zones rather than from the intersection of independent sets of fractures.

In all the oreshoots there are slabs of almost barren rock intercalated in the ore. What is true on a small scale is likely to be found to be true on a larger scale; that is, there may in places be zones of sheared and mineralized rock near and approximately parallel to known lodes, but separated from them by rock so little altered that it offers no clew to their presence. Essentially, this condition exists at the Harmony mine, where six lodes are recognized in an area 6,500 ft. long and 1,500 ft. wide, and at the Dishman prospect, where there are a number of exposures of mineralized rock over an area of mountainside a few hundred feet wide across what appears to be the dominant strike. Similar conditions are suggested by exposures at some of the other properties. From the description given it is evident that, whenever operating conditions at any of the properties warrant expenditure for development, search should be undertaken laterally from known lodes both by trenches and stripping on the surface and by crosscuts underground.

In a number of the deposits there are cross fractures

[1]Umpleby, J. B.: "The Geology and Ore Deposits of Lemhi County, Idaho." U. S. Geological Survey Bull. 528, 1913.



The north end of the Lemhi range. The Pope-Shenon mine is near the edge of the picture. The foreground is the flood plain of Salmon River; the light-colored bluffs are "lake beds"; the dark hill on the right is Tertiary lava and the main mountain mass is carved from metamorphic rocks.

lined with gouge or breccia intersecting the main lode at various angles. Some of these are mineralized in a manner similar to that of the main shear zones; others are unmineralized and evidently of later date. Only one of the post-mineral fractures so far discovered in the mines offsets the lode as much as a score of feet, and none have caused serious difficulty in following the lodes.

In each of the more extensively developed lodes a single roughly lenticular oreshoot has been found, but more may well be discovered as development progresses. Typical shoots have average widths of the order of about ten feet and stope lengths of a few hundred feet. Some of the shoots so far as developed will yield totals of over 20,000 tons of ore, and may, if persistent in depth, furnish several times this amount. Present developments indicate that a vertical range of at least two or three hundred feet can be confidently expected for single shoots, and some may well continue downward several hundred feet below the present lowest development. The character of the mineralization encourages the hope that it will prove to be persistent in depth. The oreshoots, in general, occupy the greater part of the known width of the lodes where they occur, but are bordered at both ends along the strike by comparatively barren rock. The transition between ore and waste in most places is rather abrupt.

The precise cause for the localization of oreshoots doubtless varies in different lodes. However, from the data obtained at the Pope-Shenon and Harmony mines it is believed that the general rule is that an oreshoot may be expected at any place along a shear zone where conditions at the time of ore deposition were such as to produce more than average permeability in the rock of the zone. At the Pope-Shenon mine it was a zone of somewhat unusually pronounced schistosity intersected by the shear zone; at the Harmony it was the abundance of fracturing at intersections or junctions of shear zones.

Structural Relations of the Deposits

The copper mines and prospects examined lie along a curved zone which extends from near the head of Perreau Creek in the Salmon River Mountains eastward across Salmon River, around the north end of Lemhi range and down the east side of that range as far as Hayden Creek. The total distance is about 28 miles. A number of ore deposits containing copper minerals, described by Umpleby, lie on the west flank of the Beaverhead Mountains near the crest of the range along a line which is nearly parallel to the trend of Lemhi Valley. They thus correspond in distribution on the east side of the valley to those examined in the present investigation on the west side. Umpleby has also described several copper deposits farther west in the Salmon River Mountains and Yellow Jacket range near the large masses of granitic rocks, and a few elsewhere in Lemhi County, besides many ore deposits which do not contain noteworthy amounts of copper.

Copper Lodes Strike Northwest

From a study of the data on the strikes and dips of the various deposits in Lemhi County gathered by Umpleby and by myself, it appears that although there are numerous local variations, certain generalizations can be made. Of the seventeen copper deposits whose strikes are known, twelve have strikes between N. 25 deg. W. and N. 70 deg. W., and only one has a northeast strike. Of the thirty-five ore deposits other than copper deposits with recorded strikes, twenty-two have strikes between N. 10 deg. E. and N. 75 deg. E. Two have northwest strikes. The remaining eleven are recorded as striking north or east, but a number of these appear to be based on approximate estimates rather than measurements. Thus, in general, the lodes containing copper strike northwest and the other lodes strike northeast. It will be noted that these sets of strikes correspond respectively to the trends of the two sets of structural features produced at about the end of Cretaceous time. Furthermore, the majority of the deposits are grouped along lines parallel to the trend of Lemhi Valley, which appears to be due primarily to crustal movement. Many of the deposits not grouped along Lemhi Valley are in the proximity of masses of granitic rocks. These facts strongly suggest genetic relations between the ore deposits and the batholithic intrusions and structural disturbance which took place at the end of the Mesozoic.

Extended discussion of the mineralization will be reserved for the final report. In brief, the evidence at hand indicates the following sequence of events in the production of the ore deposits: The quartzitic rocks

View taken near the head of Spring Creek, showing the rolling upland near the summit of the Salmon River Mountains. The distant knob is granite, and the rest of the picture shows metamorphosed sedimentary rocks

which now contain the lodes have been regionally metamorphosed and a large part of their metamorphism appears to have been produced by the action of aqueo-igneous agencies related to the batholithic intrusions which took place at the end of the Mesozoic. The first stage in the mineralization along the shear zones was rather intense alteration of the rock. Away from the shear zones similar alterations took place to a less degree. The non-metallic minerals in and away from the lodes represent introduction of silica, iron, alkalies, and possibly other substances as well as recrystallization of material already present. The hypogene metallic minerals were introduced into the lodes at a somewhat later stage, and much of the vein quartz consolidated later than the sulphides. Fine-grained muscovite was among the latest non-metallic minerals to form and appears to be in part later than some of the metallic minerals.

Ore Averages 2½ to 6 per Cent Copper

The average ore mined at present carries 2½ to 6 per cent copper. Ore containing 10 to 20 per cent copper has been found, but the quantity of ore of this grade in bodies sufficiently large to be mined separately is small. Some ore rich enough to be shipped without further concentration is obtained by hand sorting. Most of the ore in the deposits examined contains negligible amounts of gold and silver. In contrast to this, most of the copper-bearing deposits in the country described by Umpleby were worked primarily for their gold content.

Most of the sulphide ore in the mines, even down to nearly 300 ft. below the surface, shows incipient oxidation in places. On the other hand, unoxidized sulphides are found at or near the surface in all of them. Some oxidized ore has been mined, but in general the amount of oxidized material in the ore is insignificant compared to the essentially unaltered sulphide. Ore specimens from a number of the deposits contain chalcocite. Here, as in most regions where it occurs, the chalcocite was evidently deposited by downward percolating water which derived its copper content from the leached upper parts of the orebodies. Much of the chalcocite shows incipient oxidation to copper pitch ore. The amount of chalcocite present in most of the ore is too small to enrich it to any considerable degree.

The rare mineral delafossite, a copper-iron oxide ($Cu_2O\ Fe_2O_3$), deserves special mention. It occurs at the Pope-Shenon mine in a quartzitic rock with a peculiar layered structure suggesting deposition by a process of diffusion.[2] The layers in most specimens are in the form of irregularly concentric ellipsoids. The relations of the delafossite to the non-metallic minerals suggest strongly that it was produced during the original mineralization and not during oxidation by descending water. The delafossite in the three other places from which it has been reported[3] appears to have been formed during oxidation. The identity of the delafossite from the Pope-Shenon mine was determined by means of a chemical analysis by W. T. Schaller, of the U. S. Geological Survey. It is in small, very inconspicuous black grains in the darker layers of the rock described. The pure mineral contains, according to its formula, 42 per cent copper, and is therefore well worth looking for in a copper mine, even though its recovery may present some difficulty because of its dissemination in small interstitial grains in the quartzite. If carefully searched for it may be found to be present in notable quantities in other deposits in the region.

Prospecting Suggestions and Conclusions

In the area containing the known copper deposits there are few satisfactory rock outcrops, and the outcrops of the lodes are not sufficiently striking in appearance to be conspicuous even where exposed. Copper deposits may therefore be both more extensive and more abundant in the region than is now realized. Copper deposits of the type here described are probably confined to the metamorphic rocks, and their distribution may be related to some of the larger structural features of the region, but these facts do not serve greatly to restrict the area to be searched in prospecting. All shear zones should be examined, as it is quite possible that a valuable oreshoot may exist at depth in a shear zone showing little evidence of metallization at the surface, and the alteration in parts of zones free from sulphides is inconspicuous. Comparatively intense alteration in a shear zone is a favorable indication, although the presence of sulphides or their oxidation products is the most satisfactory guide for further prospecting. Intersections of shear zones with each other or with cross fractures of any kind, even if unmetallized where exposed, deserve a certain amount of development in search of possible oreshoots at depth. Fractures filled with cemented fragments of the wall rock are fairly common, but none of these is known to be mineralized and they should not be confused with mineralized shear zones.

In conclusion, both the local conditions affecting the ease and cost of operating and the geological data available are reasonably favorable. It appears that, given a situation in the copper industry warranting the development of new properties, this district should repay investigation and investment, and might prove to be of greater importance than is suggested by the present rather meager development.

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[2]Liesegang, R. E.: "Geologische Diffusionen," p. 180, Wien, 1913; review by Adolph Knopf in *Economic Geology*, Vol. 8, p. 803, 1913.

[3]Friedel, M. C.: "Sur une combinasion naturelle des oxydes de fer et de cuivre, et sur la reproduction de l'atacamite." Comptes Rendus, Vol. lxxvii, pp. 211-214, 1873.

Rogers, A. F.: "Delafossite, a Cuprous Metaferrite From Bisbee, Arizona." *Am. Jour. Sci.*, fourth series, Vol. 35, pp. 290-294, 1913.

"Delafossite From Kimberly, Nevada." The *American Mineralogist*, Vol. 7, No. 6, pp. 102-103, June, 1922.

Marketing Crude Petroleum

An Account of How the Business Is Conducted from Well to Refinery

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PROBABLY there is no raw material so peculiarly sensitive to its immediate market as crude petroleum. Being a liquid, if oil is found it must be handled with dispatch. To find it is, to all intents and purposes, to dispose of it. Granted a free flow, crude oil can be "mined" from the bowels of the earth and "manufactured" or refined in practically the same day, with its chief product running a motor in very nearly the next day. The only time that oil is not on the move is when it is in tanks for settling or when it becomes storage oil.

If the market absorbs it, many of the troubles of the producer may be forgotten. If there is saturation, an operator may be likened to a man who tries to stop a belching leak in his water pipe standing up to his knees in the dampness of his cellar and grasping the pipe between his fingers. Even this picture is inadequate. The householder does succeed in stopping the flow. Probably his wife thinks of turning off the water and calls the plumber. The individual oil operator cannot so easily tell his driller to turn off the oil. It can be done, but whether he gets his well back again is a question.

Not only is petroleum highly mobile, but it is subject to rapid change in the rate of flow. Pools come in over night. Wells that start producing at the rate of 5,000 bbl. a day may fall off to 500 bbl. and less and pass out of the picture entirely in the short space of a few days.

Uncertainty of Future Production a Market Factor

Moreover, there is the difficulty of finding the oil in the first place—the uncertainty of future production which always is a factor in the crude-oil market, inasmuch as the extent of current drilling campaigns is determined by production prospects. If there is an oversupply and the prospects are for this condition to continue, drilling operations are naturally restricted. If, on the other hand, there is indication of a shortage of supply, drilling must be planned and operations started in advance of the condition in an attempt to forestall it.

Actual drilling operations only can determine the productivity of a pool. Only after limits have been defined by test wells and the production records of these wells have become available can fairly accurate guesses be made as to the pool's potential output. The rapidity with which this becomes actual production depends upon many factors; the number of wells being pushed down to the pay sands, the field storage facilities, the pipe line outlet.

Many Grades of Crude Oil

The economic factor of the marketability of the crude is highly important. Oil in one field or even in the same field may be dissimilar in properties and composition from oil in another or the same field. Many pools have wells producing oil of different gravities from different sands. Probably there is no important raw material the grades of which vary so much as in oil. Grades, qualities, and price of oil run into a long list.

At present the most important product of crude oil is gasoline. Therefore, oil with high gasoline content has the readier market. The demand for specific petroleum products often determines the marketability of the crude oil of a specific field.

Virtually all crude oil produced in the United States is refined—that is, manufactured. The principal products of petroleum are gasoline, kerosene, fuel oil, gas oil, and lubricating oil. There are, however, literally hundreds of products made from crude oil and put on the market. The complete refinery derives from a barrel of crude oil a whole gamut of merchantable products.

Wide Range of Products

From the first rising hydrocarbon gases the refinery derives liquefied gases used for metal cutting and illumination, petroleum ether for laboratory uses and for priming motors; alcohols yielding solutions merchantable in lacquers, soaps, phenol, gums and resins, and derivatives embracing a wide range of products of chemistry; gas black for rubber tires, inks, and paints; fuel gas, and light naphthas, yielding gas machine gasoline for domestic illumination, pentane for candle-power standardization, hexane for laboratory uses, and chemical solvents for drug extraction.

From the white distillates are derived intermediate and heavy naphthas, producing aviation gasoline, motor gasoline, commercial solvent, blending naphtha, varnishmaker's and painter's naphtha, and dyer's and cleaner's benzine; and also refined oils, yielding kerosene for lamps, stoves and motors, signal oil for railroads and lighthouses, and mineral seal oil for coach and ship illuminants and gas absorption oils.

Intermediate Products

From intermediate distillates are derived gas oil used for carburetion of water gas, metallurgical fuels, cracking into gasoline and Diesel fuel oil; and absorber oil for gasoline and benzol recovery.

From heavy distillates are derived the white lubricating oils for baker's and confectioner's machinery, and medicinal oils, salves, creams, ointments, and the like; saturating oils, emulsifying oils, electrical oils and flotation oils; also wax of a range of utility from chewing gum to roofing material, and a range of lubricating oils embracing every type of machinery or mechanical locomotion.

From the residues are derived petrolatum and grease; residual fuel oil for boiler fuel and gas manufacture; pitches and road oils for roofing, paving, and similar uses, and coke for carbon brushes, carbon electrodes, and fuel.

From refinery sludges are derived sulphonic acid used as saponification agents and demulsifying agents; oils

and pitches marketable as fuel oil, asphalts, saturants, and binders; and sulphuric acid used for fertilizer manufacture.

This description of the manifold products and the wide range of utilization of products, written from a chart recently prepared by the Standard Oil Co. of New Jersey, embraces the refining of paraffine base, naphthenic base, asphaltic base, and mixed base crudes, and is given as essential to a consideration of the problem of marketing crude oil.

American Oil Industry Widespread

Oil occurrence and development in the United States are spread over a great territory. From 1859, when the first oil well was drilled in this country, until early in 1900 production was confined to the eastern states, the producing divisions as known to the trade being the Appalachian district, comprising Pennsylvania, New York, southeastern Ohio, and West Virginia, later augmented by Kentucky and in a small way by Tennessee; the Lima, Ohio-Indiana district, and the Illinois district.

The Gulf Coast producing district was ushered in by the famous Spindletop development near Beaumont, Tex., in 1901. Production in the present great Mid-Continent district began to attain commercial importance around 1904. This district embraces Oklahoma, Kansas, north and central Texas, north Louisiana and Arkansas. The Rocky Mountain district, comprising Wyoming, Montana, and Colorado, first showed substantial production in 1912, with the development of the Salt Creek pool, in Wyoming, although a small quantity of oil had been produced in Colorado since 1887.

California, which until late in 1922 was generally considered an industry unto itself, being but remotely influenced by, and itself but indirectly influencing, the outside industry, scored its first oil well as long ago as 1866, but it was not until 1895 that production of the state reached the million-barrel mark annually.

Source of Major Supply Constantly Shifting

Table I gives the production of the major division for specified years:

Table I—Petroleum Production of Major Divisions in 1890, 1900, 1910, 1920 and 1923

	1890	1900	1910	1920	1923
Eastern (*a*)	45,145,838	59,054,383	67,289,802	44,464,000	39,821,000
Mid-Continent	1,200	917,225	59,217,582	250,111,000	343,928,000
Gulf Coast	54	.....	9,680,465	27,682,000	31,561,000
Rocky Mountain	368,842	322,835	355,224	17,282,000	46,663,000
California	307,360	4,324,484	73,010,560	103,377,000	263,729,000
Others	278	1,602	3,615	13,000	.....
Totals	45,823,572	63,620,529	209,557,248	442,729,000	725,702,000

(*a*) Appalachian, Lima, Ohio, Indiana, and Illinois.

The gain in production of one division and the decline in another are factors of vital economic importance. In a large way they illustrate the constant shifting of the source of supply as new pools are developed. In the oil industry pools come and go. Some do no more than contribute their share toward a stabilization of supply and demand; others do so prominently; and still others contrive to flood and break the market. But as pools come and go much is involved in the way of scrapping of existing equipment and the building of new.

An industry of hundreds of separate and distinct pools, with each of its 300,000 producing wells a separate mining enterprise, each new pool must get its pipe lines before it can figure commercially. Oil discovery does not stick to main traveled roads, but betrays a geographical as well as a geological elusiveness, bobbing up in places remote and inaccessible.

The shifting of the source of supply and the importance of transportation can best be illustrated by reference to the development of three great flush pools in California in 1923. California already had more production that the district could consume. As the pools created an unexpected condition of supply apparently beyond the control of the industry, the development of a market for this production and the transportation of this supply were industrial achievements of noteworthy rank. Pipe lines were built out of the fields to tidewater, huge storage tanks were erected, and tanker fleets moved California oil at the rate of from 150,000 to 200,000 bbl. a day to refineries on the Gulf Coast and Atlantic Coast, where formerly a cargo of California oil had been a novelty. This movement of oil to market emphasizes the tanker as a real factor in oil transportation. Without the pipe line and the tanker California's three major pools would probably today be isolated, struggling to find a market for an insignificant output.

Refineries Get Most of Domestic Crude

Most of the crude oil produced in the United States, as previously stated, is refined. Certain grades under certain conditions are used directly as fuel. In California an appreciable percentage of the production of heavier grades of crude oil is used without refining by locomotives and in industrial plants. In some oil fields, crude oil is used as fuel under boilers. Principally, however, crude oil goes to the refineries. It is the raw material upon which the refinery operates and from which is obtained the various products known to every consumer. Its disposition is dependent upon the ability of the refiner and marketer to dispose of the finished products. Therefore, in a restricted sense, refinery demand may be said to be the principal factor in influencing the marketing of crude oil.

Generally speaking, refinery divisions comprise those situated in or near the oil fields close to the source of supply and those situated in large consuming centers. The largest refineries are found invariably in or near large cities, with many large plants along the Atlantic, Gulf, and Pacific seaboards. Capacity of individual refineries ranges from a plant capable of handling only a few hundred barrels of crude oil a day to 50,000, 100,000 bbl. and more a day.

Types of plants vary from complete refineries which completely separate and treat crude oil, manufacturing the entire range of petroleum products, to those specializing in the manufacture of only a few products or simply skimming or topping the crude for gasoline and fuel oil. Many of these latter plants are situated in the Mid-Continent territory and are classed as field refineries.

United States Greatest Consumer of Crude and of Refinery Products

In addition to being the greatest producer of petroleum, accounting for over 60 per cent of the world's output, the United States, being also far in the lead in the matter of refineries, has the greatest refinery demand and is as well the greatest consumer of petroleum products. To meet its own requirements and the export and bunker fuel oil demand, it must import oil and does import, chiefly from Mexico, about 80,000,000

bbl. of crude, fuel, and refined oils annually. Its coastal refineries, its tanker facilities, and its great marine and tidewater industrial markets constitute a natural economic attraction for accessible foreign crude oils and fuel oils. Imported Mexican oil is used principally to supply marine and industrial demand for fuel oil, and only a relatively small yield of gasoline is obtained.

Table II gives United States production, imports, consumption, and stocks of crude oil over a period of three years:

Table II—United States Production, Imports, Consumption and Stocks of Crude Petroleum, 1921-23

	1923, Bbl.	1922, Bbl.	1921, Bbl.
Production	725,702,000	557,531,000	472,183,000
Imports	82,015,000	127,308,000	125,364,000
Exports	17,400,000	10,153,000	8,940,000
Stocks (Dec. 31)	333,053,000	264,578,000	185,623,000
Indicated U. S. consumption of domestic and imported oil	710,739,000	592,442,000	420,462,000

Storage and Transportation Facilities Vital Factors

The production or outlet for crude oil from any pool is dependent, first, upon the ability of the producer to store the oil on his lease; second, upon the ability of the pipe-line company to run the oil; third, upon the ability of the purchaser or refiner to store the oil, and, fourth, upon the ability of the refiner to run the oil through his stills and dispose of the resultant refined products.

The many difficulties in maintaining a balance between supply and demand involve the seasonal factor only to a relatively small extent physically, although financially it is a great factor. It is necessary, for instance, to accumulate great stocks of gasoline during the winter months, so that summer demand can be met, and this means that refinery runs of crude oil are practically steady the year around, or, in other words, that refinery demand for crude oil is fairly consistent. The seasonal factor does not affect the production of crude oil, but is reflected in storage of refined products. The effect of winter weather upon field operations and production is negligible, taking the country's operations as a whole.

Quality of Petroleum Determines Price

When a producer drills a well which strikes oil he is immediately concerned as to the quality of the oil and as to the market for the oil. Petroleum is an extremely complex mixture of compounds of carbon and hydrogen, containing widely varying substances in small amounts —sulphur compounds, products of oxidation, nitrogenous substances, and other things—whose exact nature is not always clearly defined.

Crude oils are variable in character; color varies from yellow, red, brown, and black, with the lighter-colored oils very mobile and the black usually viscid. Petroleum from various regions is so well distinguished by odor that it is often possible to determine the source of the crude oil in this way. In general, all varieties of crude petroleum are lighter than water, except when contaminated with finely divided mineral matter.

Petroleum lighter than a specific gravity of 0.780 is rarely found, and the specific gravity of American petroleum varies from 0.7684 to 0.9960. Lighter petroleums usually yield the larger proportion of gasoline and kerosene, and heavier oils indicate a notable proportion of high boiling fractions and of asphalt.

The producer, then, is interested in the oil from his new well from the angles of purity of the oil and quality of the oil. The crude must be free from impurities—"merchantable" oil acceptable for shipment by pipe line. The quality of the oil is the determining price factor.

Crude Bought in Two Ways

In general, crude oil is purchased in two ways. It is bought by big purchasing companies at "open market" prices that are announced or "posted" by such companies. These companies in turn either store or sell the oil to refiners after arranging for its transportation by pipe line. The other way is the purchasing direct from the producer by the refiner, either for current needs at the established posted prices or for long-term requirements by contract. Frequently the refiner offers premiums over the posted price.

The usual practice is for the producer, after bringing in his well, to get in touch with the local representative of a purchasing company and to ascertain whether it is in the market to buy the oil. If it is, he communicates with a pipe-line company and asks if it will lay a line to his well. The well may necessitate laying a line less than a mile long or sometimes for distances greater than thirty miles. If the pipe-line company feels that the well or wells to be drilled justify the investment, it connects up the property.

Gathering Service by Pipe-Line Companies

The producer runs his oil from the well to his settling tanks—these tanks are located on the lease and usually have a capacity of from 250 to 500 bbl.—and the purchasing company then buys the oil at the posted price. The oil is sent to the pipe-line company as part of the purchasing company's tender of shipment to its customers. In most cases the pipe-line company has nothing to do with the purchase of the oil, and is only responsible for it while carrying it and delivering it to its destination.

The short line built to a lease is called a gathering line. Gathering lines are usually 2, 3, or 4 in. in diameter and run from the lease to the lateral or main trunk pipe lines. Lateral lines are 4, 6, or 8 in. and main lines, 8, 10, or 12 in. in diameter.

Briefly, gathering service consists of gathering the oil from the producer's tanks at the well and transporting it by gravity or propulsion to trunk-line stations. It also includes the measuring of the oil, which in turn includes the measuring and strapping of the tauks and the computation of their capacity. A gathering charge is made and is usually a flat charge and does not involve the distance which the oil must traverse between well and trunk-line station. Gathering charges sometimes vary according to the pipe-line company.

The procedure just outlined applies in the case of a producer without transportation or refinery affiliations. Some companies embrace the complete cycle of petroleum activity, engaging in producing, transporting, refining, and marketing. Pipe-line operations, however, are as a rule handled by separate companies acting solely as carriers, and a large company with its own production pays the fixed transportation charge to the pipe-line company in having the oil delivered to its refinery. A good many refineries located in producing areas have pipe lines which function as an

integral part of the company's operation. Some pipe lines exercise the function of purchaser and seller.

Only a small quantity of crude oil is transported in tank cars by railroads. Often before a new pool is developed to the point of justifying the building of pipe lines into the field, the entire movement of oil is by rail. In some instances, in the case of small pools, crude oil is transported by pipe line to loading racks on a railroad siding, and the oil continued to its destination by rail. It is safe to say that the entire production of about 2,000,000 bbl. a day moves by pipe line during some stage of its progress to market.

The Pipe Line an Important Factor

The pipe line is often referred to as the most important single factor in the functioning of the oil industry. Its permission of sustained bulk transportation makes possible the steady, virtually uninterrupted flow of oil from the well to the market, without which the oil industry as it exists today could not operate.

Major trunk lines out of the Mid-Continent field carry the oil south to the Gulf Coast, where there are large refineries and also terminals for reshipment of the oil by tanker to refineries on the Atlantic seaboard north to great consuming-center refineries in the Middle West, notably at East St. Louis, Wood River, Ill., and Whiting, Ind., near Chicago; and east to great refineries at Bayonne, N. J., New York City, Philadelphia, and Baltimore. For instance, oil produced in central Texas is delivered by pipe line to Bayonne, a distance of 1,500 miles.

The more important trunk-line systems are those of the Prairie, Sinclair, Gulf, and Texas companies and the so-called Southern and Northern tiers of pipe lines linking the Mid-Continent systems with the east coast refineries.

Pipe lines in interstate commerce are common carriers. The pipe-line common carrier law was passed in 1906, its validity was disputed, and it was upheld in the Supreme Court in 1914. Under the law pipe lines are under the supervision of the Interstate Commerce Commission. In many oil-producing states interstate pipe lines operate as common carriers subject to regulation by state commission.

In general, the pipe-line companies impose five requirements upon shipments of crude oil through their lines. These requirements cover, first, a minimum quantity of petroleum received for transportation; second, the quality of the petroleum accepted for shipment; third, identity of crude oil delivered; fourth, loss of crude in transit, and, fifth, terminal facilities.

The minimum quantity specified in the schedules governing shipments on common-carrier lines ranges from 10,000 bbl. to 100,000 bbl., depending on the company, although certain large carriers require only a nominal minimum. In the recent case of Brundred Bros. vs. Prairie Pipe Line Co. the Interstate Commerce Commission ordered the latter company to revise its minimum tender rule downward from 100,000 bbl. to not in excess of 10,000 bbl. between points involved in the case.

The question of minimum tenders is a moot one in the industry. Governmental investigating bodies ever since the common-carrier law was affirmed have taken the position that establishment of any substantial minimum precludes the use of the line by any but large producers or purchasers and defeats the purpose of the common-carrier law. On the other hand, the pipe-line companies assert that it is impracticable from an operating standpoint to receive small tenders.

The pipe-line companies stipulate that oil tendered must be free from water or other foreign or injurious substances. Some of the schedules requiring that the oil be a "good, merchantable oil" also stipulate the gravity. Rules adopted by the Railroad Commission of Texas stipulate that by the term "marketable oil" is meant any crude petroleum adapted for refining or fuel purposes, properly settled and containing not more than 2 per cent basic sediment, water, or other impurities above a point 6 in. below the pipe line connection with the tank.

Crude petroleum is accepted for transportation in some cases on the further condition that it shall be subject to such changes in quality while in transit as may result from the mixture of it with other petroleum in pipe lines and tanks of the carrier. Pipe-line companies do not deliver to the consignee the identical oil shipped. They stipulate that they are under no obligation to make delivery of the same oil which may be received; but all oils received for shipment are to be delivered out of the common stock of oil at the delivery station.

Oil losses normally occur during transportation, especially as a result of "shrinkage and evaporation," and the companies contract, therefore, to deliver only from 97 to 99 per cent of the crude oil shipped.

Consignees of crude oil must have sufficient storage facilities to receive the shipment promptly when it reaches its destination. Pipe-line transportation rates are established and placed on file with the Interstate Commerce Commission.

Producer Gets Cash—A 10-Cent Marketing Charge

The purchasing company pays the producer cash for the latter's oil, in some cases it being customary to mail out checks twice a month. Typical large purchasing companies are the Prairie Oil & Gas Co. and the Sinclair Crude Oil Purchasing Co. These companies do not operate pipe lines, but they have huge storage facilities. For their services in handling the oil they charge their customers—the refiners—10c. a barrel, usually referred to as the marketing charge.

When a sale is made by a purchasing company it makes a tender of shipment to the pipe-line company on its particular tariff covering the movement to destination, and when the oil is received at destination the purchasing company is paid for it. No oil is transported for the account of the purchasing company and then sold. The ultimate purchaser—that is, the refiner buying his oil through a purchasing company—pays the posted price for the oil, plus the gathering charge, plus the freight, plus the marketing charge.

Tendency Toward Direct Purchasing

Direct or virtually direct purchasing by major refining companies, notably the Standard Oil companies, is a recent pronounced tendency. Several years ago the Standard Oil Co. of Indiana, one of the Prairie Oil & Gas Co.'s principal customers, acquired a 50 per cent interest in the Sinclair Crude Oil Purchasing Co., and since that time has been doing much of its buying of crude oil through that organization. The Standard Oil Co. of New Jersey, another large customer of the Prairie, has in the last year made important purchases direct with Mid-Continent and California producers.

Probably only the so-called long-term contracts for American crude oil running into large quantity are those concluded by eastern refiners for California crude. Heavy purchases of California oil were made possible in 1922 and 1923 by the big overproduction of oil in that state. These contracts are for quantities which involved deliveries running from one to possibly not in excess of three years. As a rule the price is on a current market basis—that is, fluctuating with current prices of crude oil or refined products. When a large production is developed in a new pool by a single company, it is not unusual for the large purchasing companies to contract for a stipulated quantity, involving regular stipulated deliveries at a flat price holding for the indefinite term of the contract.

Generally speaking, however, the crude-oil business is a spot business, operating on a day-to-day basis. The large refiner buying through a purchasing company does not contract for the purchase of crude. It buys in quantities of say from 100,000 to 200,000 bbl., stipulating the kind of oil it wants and agreeing to pay the posted price obtaining at the time the order is placed. It actually pays for the oil when it is delivered.

An exception to the rule of spot crude-oil marketing is California. The production of crude oil in that state is largely concentrated among several large companies. What oil these companies do not produce is largely purchased by them. Under the system of purchase and sale of crude petroleum in California, practically all crude is purchased on contract.

The only noteworthy instance of co-operative selling in the crude-oil business is the Independent Oil Producers' Agency, whose members are confined to producers operating in several California fields. This was organized in 1904. Each member is required to own stock in the organization and is limited to one share. After organization, the agency combined with another similar agency operating in one of the California fields. In 1909 the agency entered into a contract with the Union Oil Co. of California whereby the latter was to build a pipe line and become exclusive sales agent for all the crude oil marketed excepting that used for the manufacture of asphaltum. This contract has been changed several times since.

A system peculiar to California, although somewhat similarly practical in the Mexican oil fields, is that of exchanging crude petroleum of the same or different qualities. This is prevalent among the large marketing and producing companies. One company will exchange with another as a means of economy in transportation.

Quality of crude oil has in recent years become an increasing consideration as regards its market and its price. As previously stated, gasoline is the most important product of crude oil. A prominent oil executive describes it as the controlling product from the standpoint of the quantity of crude run, or, in other words, the crude is being run to meet the gasoline demand of the country. Therefore the more gasoline content there is in the crude, the more valuable the crude automatically becomes.

As late as 1922 the major purchasing companies in the Mid-Continent field were putting one price for all Mid-Continent oil, irrespective of its quality. It is true, however, that certain of these companies were paying a premium over the posted price for oil of certain fields having a large gasoline content. Moreover, the practice of premium paying was general among Mid-Continent refiners, particularly those without pipe-line facilities, not only as a reflection of their efforts to obtain high-grade oil but as a means for them to obtain small and irregular quantities of the necessary raw material when needed.

Late in 1922 all purchasing companies which had not previously done so discontinued their practice of quoting one price for Mid-Continent oil and adopted scale prices according to the gravity of the oil. Purchasing in practically all fields is now generally done on a gravity basis.

Going on Shift at the Largest Gold Mine in the United States

Miners at the Homestake Mine, in South Dakota, have a record for long employment with the company. Many have worked for more than fifty years with it

Part of the Fort George Canyon on the Fraser River. The scow with the machinery was dragged through this boiling inferno!

A Monument for Disappointed Hopes

WHEN the Cariboo gold fields of British Columbia began to fall off in production, about forty years ago, there was an earnest attempt to duplicate the original rich discoveries further up the Fraser River. In the early 80's an American party left Quesnel for the Little Smoky River, two hundred miles or so upstream, where the prospects at least *looked* bright. These adventurers undertook to pull a heavy dredge the entire distance and, *mirabile dictu*, successfully accomplished their object; however, bad luck subsequently seems to have dogged them, and nothing came of their heroic enterprise. The old dredging machinery still lies at the river's mouth, as shown in the cut, a monument to unlucky though courageous pioneering.

Old dredging machinery on the Little Smoky River, in British Columbia. Standing between the wheels is a half-breed who, forty years ago, remembers seeing it man-hauled past the Fort George Indian reserve by white miners

Experiments in Cobalt-Silver-Nickel Smelting

Heat of Oxidation of Iron and Arsenic May Displace Coke—Small Test Converter Proves Practicability of Process

By A. Carr Harris
Formerly Superintendent, Coniagas Reduction Co.

ALTHOUGH the experiments to be described in this paper were carried out in June and July, 1918, they should be worth recording, as a search has proved the absence of any technical literature relating to this subject. The plant of the Coniagas Reduction Co. at Thorold, Ont., smelts ores, slimes, and other materials from the famous Cobalt district of Ontario, recovering silver, cobalt, and arsenic. At the time these experiments were made it was the practice to make up the blast-furnace charge of from 40 to 50 per cent slag, 10 to 15 per cent speiss, and the remainder Cobalt ores, arsenic clinker, and any other available and suitable material, the entire charge amounting to sixty to eighty tons per day. Iron ore or limestone was used as a flux, and coke consisted of 20 per cent or more of the charge. The two principal aims were to extract the silver from the charge as quickly as possible and to make slags containing not more than 8 oz. of silver per ton.

Previously, the Cobalt ores, which had been ground to about 40 mesh for sampling, were wet with water and charged directly to the blast furnace. Sintering had, however, been found practicable, and a plant for carrying on this operation had been installed, though its operating was intermittent and its capacity inadequate.

When ore was being charged, the slags usually carried from 8 up to 20 or 25 oz. of silver per ton. These slags had to be re-run through the furnace with only speiss and coke, to bring down the assay to the allowable 8-oz. limit. To improve the slag loss, a trap spout was designed and put into operation at the slag tap hole. This made the silver content of the slags slightly less, and also made the furnace run somewhat more easily and smoothly. It also prevented speiss leaving the furnace without warning when slag was being tapped. A further lowering of the silver content of the slags, amounting to from 1 to 2 oz. per ton, was brought about by running the slag from the furnace into a forehearth 3 ft. deep. With slag from the trap spout assaying 4½ to 5 oz., the waste slag from the forehearth could thus be brought as low as 3½ oz. Often, however, the forehearth slags were as high as 12, 14, or 17 oz., even with a hot, liquid slag and a new forehearth.

High Coke Causes Low Silver Slags

It was found that the silver content of the slag was greatly affected by the degree of oxidation going on in the furnace. With high coke, and running on slag and speiss, low silver slags were made, but the silver content would be quickly doubled by cutting the coke from 20 per cent down to 3 to 5 per cent, with the addition of more speiss to supply iron for oxidation and thus heating the charge.

The possibility was suggested of concentrating the green speiss in the blast furnace, in a manner similar to that of pyritic smelting of copper ores. This might be called arsenidic smelting, the object of pyritic smelting being the oxidation of iron and sulphur, and the

object of arsenidic smelting being a similar oxidation of iron and arsenic, with a consequent higher percentage of cobalt and nickel in the speiss. In this experimental work, a slag of the following analysis was produced: Ni, 0.006 per cent; Co, 0.600; and Cu, 0.078 per cent; compared with a cobalt content of from 0.30 to 0.35 per cent with the ordinary running of the furnace.

Metallurgical Difficulties

In this work the coke was reduced down to 2½ to 3½ per cent of the charge. It was found impossible to reduce the iron content of the speiss much below 17 or 18 per cent; also, that the furnace caked up inside to such an extent in six or eight hours running that it took eight or ten hours more to melt the cake out again with high coke and slag charges. The trouble was due to the slag being so basic with iron oxide that trying to force more iron into it resulted in the formation of higher oxides of iron within the furnace about the tuyère level. As these were infusible and would not enter the slag, the formation of large masses near the tuyères resulted. If allowed to go too far, the furnace would gradually freeze up.

Later, it was found that with the addition to the furnace charge of sandstone containing a large proportion of free silica, it was possible to make a good grade of speiss. In one run, in which sandstone and slag was charged, speiss containing 14.1 per cent iron was made, compared to about 25 to 30 per cent when entering the furnace. Also, in one run on Coniagas ore and silver mud, a good grade of speiss was made in one operation, with a matte rich in silver and copper as follows:

	Fe, Per Cent	Cu, Per Cent	Ag, Oz. per Ton
Speiss	10.79	4.10	842
Matte	20.53	21.07	5,736

Four to five inches of matte separated out on top of each speiss pot. No silver button of any kind collected, although the original ore ran about 2,000 oz. The regular charge to the furnace was: 2 wheelbarrows coke (300 lb.), 4 of "mix" (1,400 lb.), 3 of slag (800 lb.), 1 of limestone (200 lb.), 1 of silica stone (250 lb.), and 3 of speiss (900 lb.). This totals 3,850 lb. about every forty minutes, with a consumption of about 7½ per cent coke. It is doubtful if this operation is good practice, as it apparently ties up the whole of the silver in the matte. The above illustration is given to show the range of the operation of the furnace.

In arsenidic smelting it is not easy to represent the reactions by a chemical equation, as the iron contained in the speiss is not combined with the arsenic in a definite proportion. However, the following might illustrate:

1. $FeSAs_2 + SiO_2 + O_2 = (FeO)_2SiO_2 + Fe_2As_2$.
2. $2Fe_2As_2 + 2SiO_2 + 2O_2 = Fe_2As_2 + 2(FeO)_2SiO_2 + As_2$.
3. $2Fe_6As_2 + 4SiO_2 + 4O_2 = Fe_4As_2 + 4(FeO)_2SiO_2 + As_2$.
4. $2Fe_4As_2 + 3SiO_2 + O_2 = Fe_2As_2 + 3(FeO)_2SiO_2 + As_2$.
5. $Fe_2As_2 + SiO_2 + O_2 = (FeO)_2 + SiO_2 + As_2$.

Any of these reactions might take place where the conditions are right, or all might occur at once. The iron is gradually decreased, with the formation of a silicate of iron and evolution of arsenic. Neither the cobalt, nickel, or copper enters the slag to any appreciable extent. To insure sufficient oxygen present for the formation of iron oxides, ample air must be admitted and the percentage of coke on the charge must be less than 12. High coke results in little oxidation of the charge; in fact, a reduction of the iron, which makes a speiss rich in iron and poor in cobalt and nickel. Free silica must also be present to unite with the iron oxides as soon as formed, otherwise higher oxides will be formed and will eventually block up the furnace, despite the fact that the slag continues to run from the furnace in a hot and apparently satisfactory condition. The furnace may gradually freeze up, with no change in the appearance of the slag until it stops running.

In arsenidic smelting, it is also of course essential that sufficient iron and arsenic be present to supply the necessary heat by oxidation. It has been found necessary that from 35 to 45 per cent of the material charged into the furnace should be irony speiss or matte, an amount which was just beyond the facilities provided for the tapping and handling of speiss at the tap hole of the blast furnace. The descending charge in the furnace was practically saturated with arsenic at all times. It did not appear that the grade of speiss made was dependent on the percentage of total arsenic in the charge, although there was a slowing up of the running of the furnace as the percentage of arsenic was increased. The grade of speiss apparently was dependent on the amount of unoxidized iron left available to enter the speiss.

Summary of Experiments on Arsenidic Smelting

The main points established by the experimental work were as follows: (1) A good grade of speiss can be made in the blast furnace directly in one operation by running ore or a mixture of ore and silver mud, or flue dust and mud, or other mixtures, together with a proportion of slag, speiss, and sandstone to carry the fine material along and to assist in melting the charge. But such operation results in slowing up the furnace so that only eighteen to twenty tons of useful material can be smelted per twenty-four hours. (2) Sintered ores may be smelted at a rate of from forty to sixty tons per twenty-four hours, with a small consumption of coke, and making a high grade of speiss. A great deal of the sintered material may be smelted directly without the addition of any slag, speiss, or other flux, and thus at a considerable decrease in cost.

Several experiments were also made at the Coniagas smelter to see if it were possible to produce a high-grade cobalt-nickel speiss in a converter, the action being similar to that in converting copper and copper-nickel mattes. The normal analysis of the speiss made in the blast furnace was as follows: Co, 15 to 20 per cent; Ni, 7 to 12; Cu, 3 to 4; Fe, 35 to 15; Ag, 3; As, 20 to 28; and S, 5 per cent. Using sintered material an exceptionally good run gave:

	Co	Ni	Cu	Fe	Ag	As	S
Speiss, per cent	26.82	16.13	3.12	12.42	3.34	29.69	6.46
Matte, per cent	5.68	1.38	16.85	18.68	28.14	0.96	21.28

This run lasted thirty-four hours, during which time nearly eighty tons of sinter cake was charged in seventy charges, with 12 per cent of coke for twenty hours, and the rest of the time with 15 per cent of coke and 15 per cent slag. About 3,400 lb. of crude silver was made, and eighteen tons of speiss.

Normally, there is always a saturation of silver and arsenic in the furnace, and the quantities of these metals in the speiss are more or less dependent on what other metals are present. In any case, they vary only

within narrow limits and can be closely predicted when the percentage of iron is known. The iron maintains a balance between the oxidizing action of the air blast and the reducing action of the coke in the furnace, which latter allows the iron to enter the speiss. It has, therefore, become customary to consider that the percentage of iron in speiss determines its grade.

First Converter Not Satisfactory

The converter used in the first experiments was a small stationary vessel built of firebrick and lined with silica brick, the inside dimensions being 48 in. long by 18 in. wide, and 24 in. high. There were eight tuyères, 2½ in. by 1½ in., placed 2½ in. from the bottom. This was not altogether satisfactory, as the speiss made was not sufficient to cover the tuyères properly, the air supply was not adequate for the design, and the speiss ran through the brickwork.

A large, cast-iron, egg-shaped pot was then used as a converter shell, being lined all around with one layer of silica brick, and having an arched silica brick cover with a hole about 4x6 in., through which charcoal and coke could be charged for heating the pot and through which the gases could escape. Four ½-in. iron pipe tuyères were inserted about 8 in. above the silica lining at the bottom of the pot, thus allowing a space for settling crude silver bullion out of the air blast. The capacity of the pot was 3 cu.ft., or about 1,300 lb. of speiss of specific gravity 7. The air pressure at the tuyères was around 15 or 18 lb., and the blows lasted from ten to eighteen minutes.

An understanding of the heat generated may be gained from the results of one of the tests: About 1,300 lb. of charge was blown for twelve minutes, the charge consisting of 72 per cent speiss (Fe, 21.11 per cent; Cu, 3.75; As, 24.83; and Ag, 371.5 oz.), 23 per cent matte (Fe, 25.75 per cent; Cu, 24.20; and Ag, 4,010 oz.), and 5 per cent of crude silver (Cu, 5 per cent; Ag, 75 per cent). The charge was much hotter at the end of the heat than at the beginning, though no temperature measurements were made. There was no difficulty on this score when sufficient air was available.

The tests proved that cobalt-nickel-iron speisses can easily be blown in a converter with the rapid expulsion of dense fumes of arsenic, antimony, and sulphur, together with the rapid oxidation of iron. A slag was formed from the silica lining, as in acid copper converting. It is also fairly certain that cobalt or nickel are not oxidized along with the iron, at least so long as 3 or 4 per cent of iron remains in the speiss. This fact was also demonstrated in the case of the blast furnace.

The course of the silver during the converter blow is not so easily apparent. The following may be noted, however:

1. A speiss containing more than 800 to 1,000 oz. of silver per ton does not occur at any stage of the blow, and the silver content may be considerably less than this.

2. When sulphur and copper are present, a matte is formed, and as the blowing proceeds, the percentage of copper contained in the speiss remains practically constant.

3. The percentage of copper and silver in the matte increases rapidly as the blow goes on, forming at the last practically a copper-silver matte.

These things suggest that if there were not so much sulphur present, the matte would become essentially a copper matte and the silver would be precipitated as crude bullion: or, looking at it the other way, if enough copper should be added to the converter to combine with all the sulphur present, a crude silver bullion would be precipitated. This might be represented thus:

$$Ag_2S + 2Cu = Cu_2S + 2Ag$$

or if iron be added instead of copper

$$Ag_2S + Fe = FeS + 2Ag$$

It may be of interest in this regard to look over the following partial analyses of mattes made in the blast furnace, where there is always an excess of crude silver, and a consequent saturation of silver in the mattes. Often considerable quantities of crude silver have been precipitated by charging these mattes into the blast furnace with scrap iron.

Blast-furnace Matte Analyses

No.	Per Cent Cu	Fe	Oz. per Ton Ag	No.	Per Cent Cu	Fe	Oz. per Ton Ag
1	21.85	22.77	2,491	9	21.35	28.29	3,091
2	26.20	21.15	1,112	10	18.49	31.08	2,033
3	18.91	33.75	3,574	11	26.80	15.75	6,068
4	23.51	23.70	4,178	12	25.33	14.26	5,976
5	20.77	31.21	3,358	13	22.10	13.34	7,452
6	21.90	28.32	4,263	14	26.80	26.08	3,204
7	21.67	26.01	3,620	15	26.80	21.00	4,213
8	20.11	28.90	4,007				

A more complete analysis of a sample of matte is as follows:

	Ag. Oz. Ton	Per Cent Ag	Cu	Fe	Co	Ni	As	S	Pb	Total
Matte No. 1	4,617	15.83	11.27	27.28	7.93	4.07	4.58	22.54	2.92	96.40
Matte No. 2	3,745	12.7	19.33	23.56	8.73	0.89	1.07	25.05	3.33	94.76

4. The fumes evolved from the converter are very dense, and consist principally of oxides of arsenic—As_2O, As_2O_3, and As_2O_5—together with some oxides of antimony—Sb_2O_3 and Sb_2O_5—and considerable amounts of silver, one sample assaying 939 oz. silver per ton of fume. Silver volatilization from the blast furnace is not so rapid, but the operation lasts a longer time so that the total silver volatilized may not be greatly different whether the concentration be carried on in the blast furnace or converter. If the sulphur were nearly all eliminated from the converter charge, the large quantity of silver matte would not be present, and doubtless the fume would contain less silver.

A possible field for investigation would be the blowing of steam, or a mixture of steam and air, through the tuyères of the converter for a short time during the last stages of the blow. This would result in the liberation of large quantities of arsenic and sulphur.

Talc and Soapstone Production Decreased in 1923

The U. S. Geological Survey reports that the total quantity and value of talc and soapstone produced and sold in 1923, as reported by producers, was 196,692 short tons, valued at $3,012,253. These figures represent a decrease from 1922 of 1 per cent in quantity and an increase of 5 per cent in value. Production for 1923 is given in the following table:

State	1923 Short Tons	1923 Value	Per Cent of Total Quantity	Percentage of Increase or Decrease from 1922 Quantity	Value
New York	71,304	$1,079,322	36	— 2	— 3
Vermont	67,100	533,510	34	— 11	— 18
Virginia	26,095	960,628	14	+ 3	+ 30
California	16,144	224,838	8	+ 3	+ 20
Pennsylvania, New Jersey	8,182	82,597	4	— 2	— 5
North Carolina	6,491	89,290	3	+ 196	+ 287
Georgia	796	16,568	1	— 47	— 59
Maryland	580	25,500		— 65	+ 74
	196,692	3,012,253	100	— 1	+ 5

Useful Operating Ideas

Setting Roll Shells

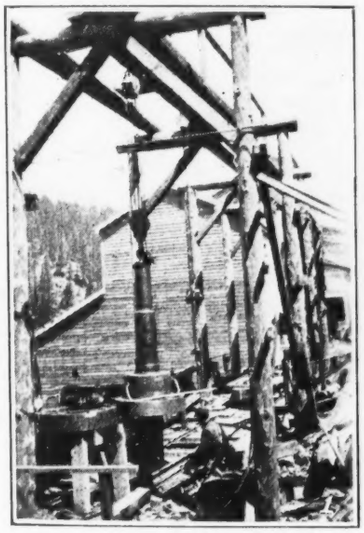
By W. I. Nelson

THE method of setting roll shells at the mill of the Engels Copper Mining Co., Engelmine, Calif., having given excellent results, is considered to be worthy of presentation. The rolls used are nominally 54x24 in., but the actual diameter of a new shell is 55¾ in. The shells are worn from 5¼ in. thickness when new, to less than ¾ in. when discarded. The life is about five months.

The roll shaft is fitted with the usual tight and loose cores, over which the shells are heated and shrunk. To minimize fire risk this is done outside of the mill building. Lifting is done by means of a near-by electric hoist, and a set of cable blocks is suspended from a wooden headframe (Fig. 1). The blocks are triple sheave, threaded with ⅝-in. cable. The roll shafts are tapped at one end to receive an I-bolt by means of which the shaft is suspended. The shells are handled by three hooks held in place by a sectional ring that can be adjusted to any circumference required by the diameters of new or worn shells (Fig. 4, *a*). The loose core is held by a tapered pin with a shoulder on one end and an eye on the other (Fig. 4, *b*). The shoulder end is inserted in a core-bolt hole and held in place by a wedge-shaped pin driven in beside it. To release, the wedge-shaped pin is pried out and the suspension pin follows easily.

The kerosene burner (Fig. 2) is constructed of two circles of 1½-in. pipe held apart by strap iron. Each pipe has diagonal saw-cut slots ⅝ in. long and 9 in. apart. Oil is fed through a ½-in. pipe which passes around the burner between the slotted pipes and joins the air pipe just ahead of the 2-in. intake. The inside diameter of the burner is 60 in. The kerosene tank is constructed of a standard 8-in. pipe with a bushing in each end. The pipe rests on the ground above the burner and has a slope of about 45 deg. Kerosene is poured in at the upper end and put under full air pressure when fed to the burner.

To insure the best results, experience has shown that it is essential that a specific amount of diametral shrinkage be obtained. This was found to be 1/1,000 of an inch per inch of mean diameter. Too much shrinkage will obviously cause the shell to break and too little will cause slippage before maximum wear has been attained. For this reason careful workmanship is required throughout the operation, and measurements taken for the calculation of shrinkage are made only by a machinist skilled in micrometer measurement.



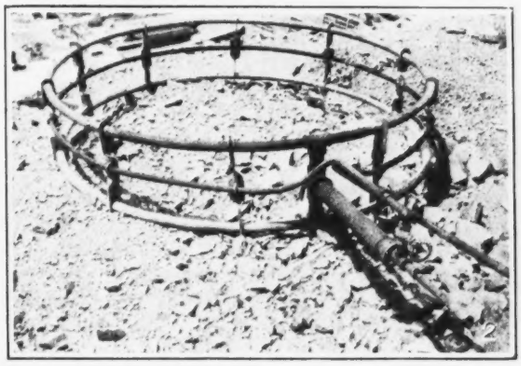


Fig. 1—Shrinking of shells on shaft is done outside of mill building to minimize fire risk. Fig. 2—Kerosene burner used in shrinking. Fig. 3—Kerosene burner in place around shell and covered with sheet-iron housing

For the first measurement, a pair of outside calipers is set to the largest diameter of the tight core as shown (Fig. 4, *d*). The micrometer, used as an inside caliper, is set to the largest inside diameter of the roll shell (Fig. 4, *e*). The difference between this diameter and the distance between the points of the outside caliper is noted on the micrometer (Fig. 4, *f*). The distance that the core is to be set in from the edge of the shell is calculated from the average of several such measurements made at different points. For example, the maximum inside diameter of the roll shell measures 0.023 in. less than the largest diameter of the core. The shells are 49¾ in. mean diameter; therefore the shrinkage to be applied is taken as 0.049 in. The face of the core and the inside of the shell increase in diameter from the center outward at the rate of 0.075 in. per inch in width. Since the core is already 0.023 in. larger than the shell, 0.049 minus 0.023 divided by 0.075 gives the distance that the core is to set in from the edge of the shell. This is approximately ½ in. The practice is to use the nearest

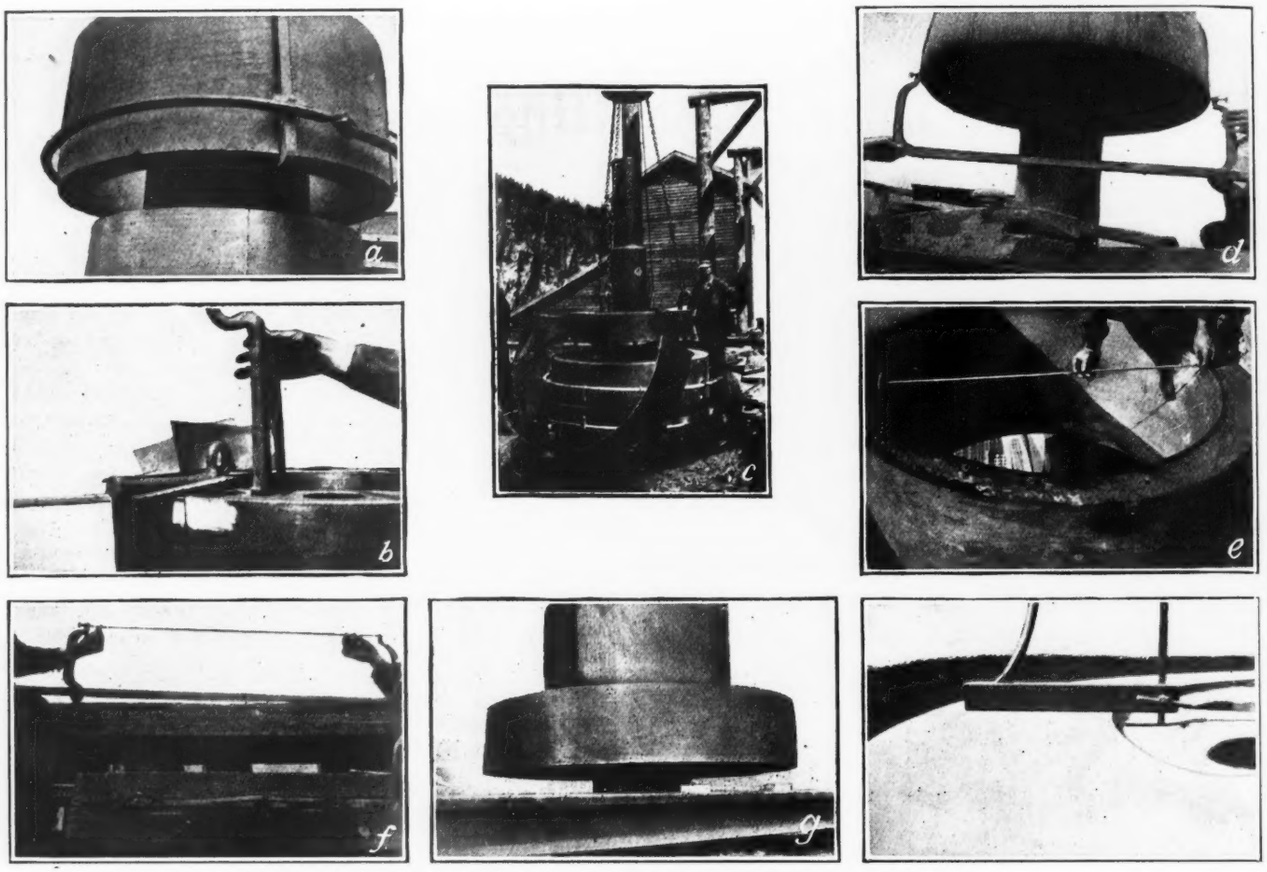


Fig. 4—Details of measurement and placing roll shell and cores. See text

thirty-second of an inch, less than the ratio obtained, making a variation of slightly over 0.002 in. in the thickness computed and used as described later.

Measurements for the loose core are taken the same as in the case of the solid core, allowance being made for the difference between the diameter of the hub of the solid core and the inside of the loose core. The distance that the loose core is to be set in from the edge of the shell is then calculated.

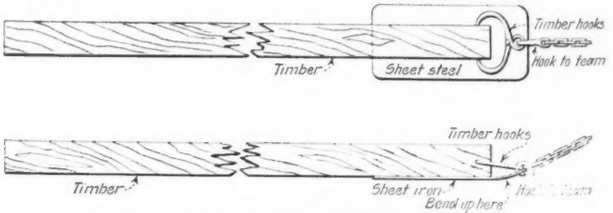
When ready to put on the shells, two heavy rails are set parallel and 36 in. apart, one on each side of a pit, and leveled. The roll shaft is up-ended into the pit and held suspended with the core a few inches above the rails. The distance blocks are so placed on the rails (Fig. 4, *g*), that they will hold the core, but allow the shell, when expanded later, to settle upon the rails. The shaft is then lowered, and the shell is placed over the tight core. The kerosene burner is put around the shell and covered with a sheet-iron housing (Fig. 3). The burner is preheated with burning oily waste until a gas is formed by the kerosene admitted into the pipes. After starting the fire, from thirty to forty-five minutes is required to expand the shell. Usually, 15 gal. of kerosene is consumed.

When the shell has expanded sufficiently to drop to the rails, the loose core is lowered and held suspended at the calculated distance in from the edge of the shell. This distance is measured by a block with an adjustable pin (Fig. 4, *h*). When block and pin both touch evenly at different points the core is in the desired position. After cooling for twenty-four hours, the shaft is removed from the pit and the core bolts are inserted and tightened. The maximum number of men needed at one time is four, including the man at the hoist. The amount of labor required to remove the old shell and replace is about fifty hours for one man.

Cores which have been in service for some time are more or less abraided and grooved on the sides by rock which has worked past the edge of the shell. When in this condition the side is dressed at four equidistant points on the outside edge so as to provide a sharp edge for calipering and a smooth face for lateral measurements. The faces are cut 1½ in. wide and extend 2 in. in from the edge. Each face is the same distance from the inside edge of the core and is at right angles to the shaft.

Drag for Heavy Timbers

In dragging heavy timbers into position over rough ground, the sheet steel drag shown in the accompanying illustration has been found to facilitate the work and to save both time and labor. The sheet steel is rounded off at all corners and is curved up at the end. A 2-in. hole is cut close to the end. A timber hook with attached hooks completes the device.



Sheet steel drag for handling timbers on rough ground

Discussion

"Engineering and Mining Journal-Press" is not responsible for statements or opinions published under "Discussion." In many cases the views expressed are diametrically opposed to editorial policy and belief.

"Socialism" on the Mesabi

THE EDITOR:

Sir—In your issue of Jan. 9 Dwight Woodbridge says:

"Minnesota is now experiencing a taste of applied socialism and the mine operators and iron-land owners do not like it. One of the Marxian doctrines elaborated in Bolshevik theories has been that by confiscatory taxation resources could become nationalized—the property of the state; and that private ownership would be eliminated. Most people have not looked forward to the adoption of this principle in the United States, although opponents of excessive taxation in Minnesota have argued for years that high taxes were leading in that direction. The small and independent owner of undeveloped iron-bearing land in Minnesota now finds himself unable to dispose of it and, incapable of paying the taxes. . . . The net result is that the small lessee or owner is being wiped out and the operating lessee or owner is mining his own lands as rapidly as conditions permit and is evincing no interest in additional reserves."

This quotation indicates that Mr. Woodbridge has no clear idea of the real distinction between Socialism and the individualistic theory of property on which modern civilization is based. Karl Marx, the high priest of Socialism, denied the right of private property in both capital (tools and improvements) and land (natural resources in their raw condition). The Bolshevik rulers, who have applied the Marxian theories to Russia, have not bothered to confiscate private property in land by the indirect method of excessive taxation but have simply "nationalized" both land and capital by the second chapter of the Constitution of 1918.

But the taxation of which Mr. Woodbridge complains has nothing in common with the Marxian denial of private property, for, at its limit, it would simply prevent individual landholders from appropriating the royalty value of iron ore, when they have done nothing to earn it beyond plastering it with a paper title often obtained in the lumber-cutting days for as little as $1 an acre. One can easily understand why the land speculator should object to the curfew being rung on his anti-social game of holding up the would-be producer, but that genuine "mine-operators" side with him I very much doubt. On my visit to Mesabi in 1908 I was astounded that prospective operators must not only sign a contract with the fee-owner to pay a royalty on every ton of ore to be extracted but must also agree to do all the prospecting at their own expense.

It is clear to any student of the history of property in land that the Mesabi fee-owning in 1908 was a complete perversion of the original reason for such property —encouragement to development—as it merely stimulated a class of dogs-in-the-manger and allowed them to grow rich by levying unearned tolls on operators. If the new taxation tends to scotch this kind of industrial parasitism, it ought to be commended by everyone who believes that property holding should be legally established on an ethical basis and that rewards should be proportional to service rendered in aiding production.

The best legal authorities agree that Teutonic history gives no basis for unrestricted private property in land and that this latter idea, on which Mr. Woodbridge's argument is based, was introduced in the Middle Ages into northern and western Europe from the legal codes of the Roman Empire. In Rome a monopoly of individualism was possessed by a few thousand landlords. Says Sir Fred Pollock:

"It is commonly supposed that land belongs to its owner in the same sense as money or a watch. This is not the theory of English law since the Norman conquest, nor has it been so in its full significance at any time. No absolute ownership of land is recognized by our law books except in the Crown. All lands are supposed to be held immediately of the Crown, though no rent or services may be payable and no grant from the Crown on record."

And Justice Longfield opines:

"Property in land differs in its origin from property in any commodity produced by human labor; the product of labor naturally belongs to the laborer who produced it, but the same argument does not apply to land, which is not produced by labor but is the gift of the Creator of the world to mankind. Every argument used to give an ethical foundation for the exclusive right of property in land has a latent fallacy."

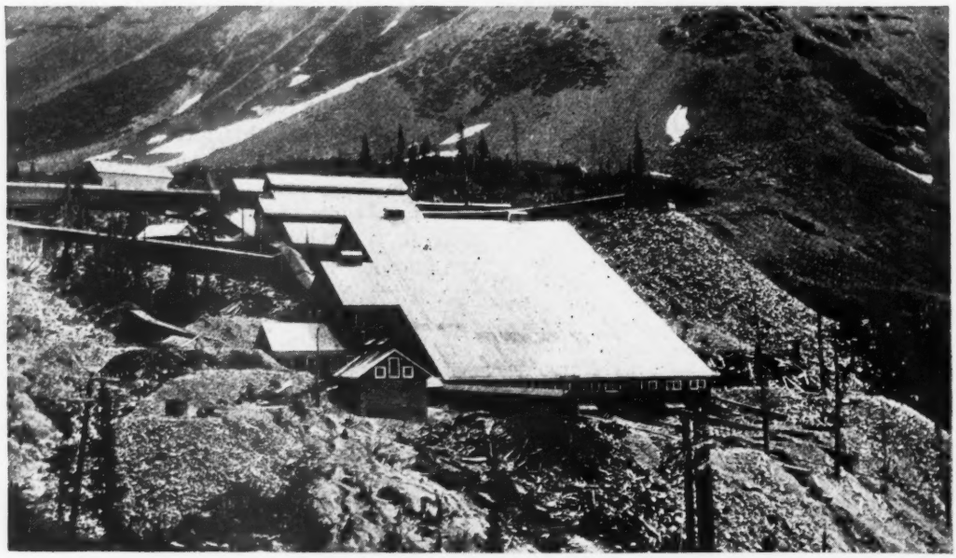
Here in Mexico the tenure of mining land, strangely enough, follows Teutonic rather than Roman principles, its features being partly due to German engineers in Colonial days and partly to three centuries of Spanish experience, in the richest mining countries of the world, and finally embodied in the *Ordenanzas* of 1783 by the famous reforming King, Carlos III. Its two fundamental principles are: (1) Inalienable public ownership of the subsoil, and (2) individual exploitation of the subsoil under leasehold titles designed to insure regular development and a fair public revenue from the output.

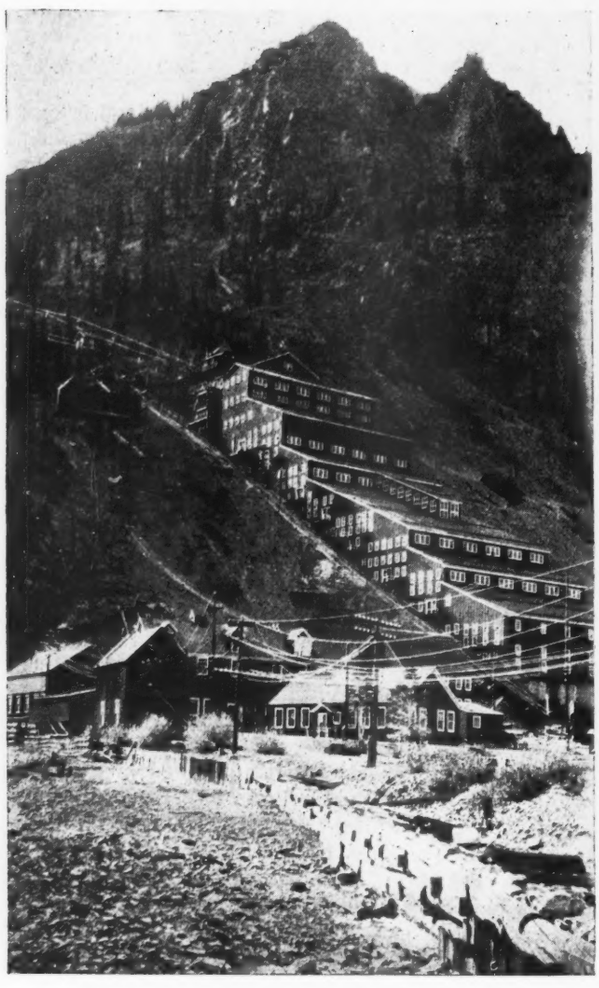
The *Ordenanzas* insured regular development by the requirement of continuous work, and when, under American influence, this sound feature was abandoned in the Mexican Code of 1892, and replaced by a trifling areal tax, the logical result was soon seen. On my arrival here in 1911, the speculators and monopolists had had a free field for twenty years and had succeeded in plastering with titles every mineral showing, even in the most remote locality. One of the few economic reforms of the Revolution has been the raising of the areal taxation to adequate rates and the cancelling of many claims for non-payment of the new taxes.

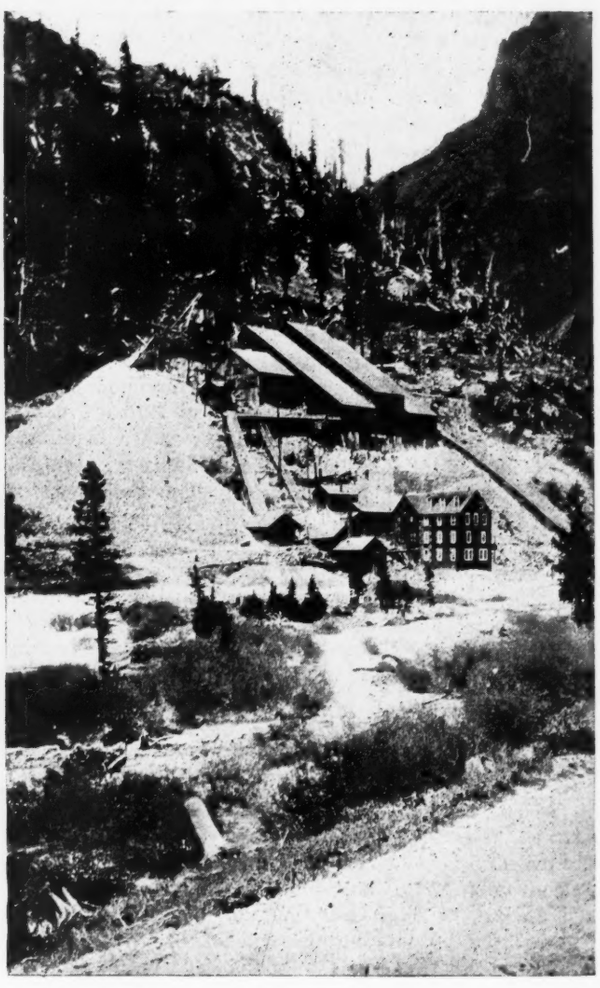
This subsoil policy may be labelled "Socialism" by Mr. Woodbridge, but its practical effect has been the encouragement of individualism beyond anything possible under unrestricted private ownership. An engineer with small capital can now easily become his own employer here by simply leasing from the nation one of its hundreds of unclaimed prospects and starting to dig. The Mexican code insures the permanent preservation of that equality of opportunity which is the ideal of democratic society but, owing to faulty laws, has never been attained in the United States except, sporadically, in some placer camps in the early days.

Ixmiquilpan, Hgo., Mexico. R. BRINSMADE.

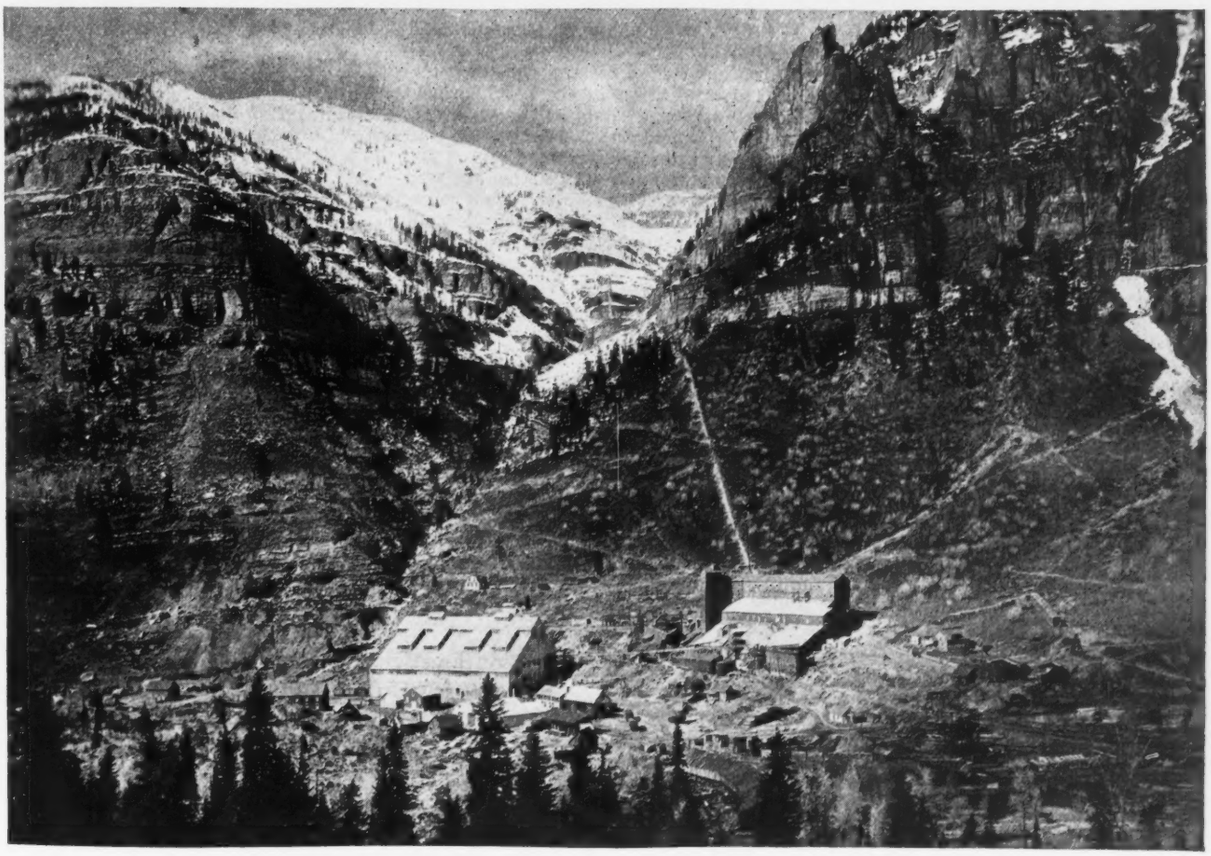
Mills of the San Juan District in Colorado







Above—Tomboy flotation plant above Telluride. Below, left—Sunnyside mill at Eureka, with tram terminal at the top. Right—Atlas concentrator, above Ouray



Above—The picturesque town of Telluride. Below—Smuggler Union plants. The old stamp mill is at the right, and to the left is the million-dollar flotation unit

News of the Week

The Mining News of ENGINEERING AND MINING JOURNAL-PRESS is obtained exclusively from its own staff and correspondents, both in the United States and in foreign fields. If, under exceptional conditions, material emanating from other sources is published, due acknowledgment and credit will be accorded.

Summary

AN ANSWER, in many respects favorable, has been made by the Federal Trade Commission to the queries of the Silver Producers' Association regarding the possible formation of a silver export organization. The reply will be available for use at the Salt Lake meeting early in August.

Adequate preparation for fighting fire averted what easily might have been a serious disaster in the Hecla mine near Wallace, Idaho.

London hears that an unnamed American copper company desires to buy into the Union Minère du Haut Katanga.

B. C. Silver Mines and other companies have made initial shipments of ore from the Portland Canal district in British Columbia.

Profits realized by the Lake Shore Mines in Ontario have been greatly increased with the enlarged mill in operation.

A new record for tonnage shipped this year was established by the Eureka district in Utah during the last week of July.

The Calumet & Hecla Consolidated will make good use of the findings of the geologic research commission in exploring the Cliff lands in Michigan.

Wages for mine and mill men in the Joplin-Miami district total approximately $1,000,000 a month.

The Colorado Fuel & Iron Co. has purchased the Wagon Wheel Gap fluorspar properties in Colorado.

One car of ore valued at $64,000 was shipped by the Tintic Standard Mining Co. in July.

New Shippers in Portland Canal District in British Columbia

Governments and Companies Contribute Funds for Improving Roads—B. C. Silver and Porter-Idaho Ship

Several of the newer companies in the Portland Canal district in British Columbia have commenced shipping despite the great difficulty of ore transportation. Though a large amount of money has been spent on them by operating companies and by the Government, the roads throughout the district are bad; they are difficult to maintain, owing to the excessive rain and snow fall and frost. The British Columbia Government is improving the Bear River valley road and the Alaska Bureau of Public Roads has let a contract to Siems & Carson, of Spokane, for the construction of an entirely new piece of road around the mountain between Seven and Nine-mile, in the Salmon River valley, at a cost of $82,000. The latter improvement, which will replace a particularly bad piece of road, will assist shippers on both sides of the international boundary.

B. C. Silver Mines has commenced shipping from the mine and is accumulating ore at the wharf at Stewart. About 50 tons, running around $125 per ton in gold and silver, will form the first shipment. This is culled ore; the average of the shoot that is being developed runs between $30 and $40. Evidence of secondary enrichment has been found at several points during the development; some ore was mined that ran as high as 30 oz. in gold and 300 oz. in silver.

The Porter-Idaho syndicate has commenced to ship ore by pack train to tidewater at the Portland Canal. Some 80 tons, averaging in the neighborhood of $200 per ton in gold, silver, and lead, has been sacked and 200 more tons will be ready before the season closes. The Idaho group, from which the ore was being taken, is situated about four miles up the north fork of the Marmot River, which enters the Portland Canal about seven miles below Stewart.

Dunwell Mines expects to start shipping some time in September, when No. 4 tunnel, which is being driven as a main working tunnel, should be completed. The company claims to have developed the shoot in the No. 3 tunnel for a length of more than 500 ft. The value of the ore, however, has not been stated, but it is described as high-grade.

The Trites, Wilson & Wood syndicate has allowed its option on the Big Missouri group to lapse. The grade of ore developed, it is stated, is not high enough to stand the 25-mile haul to tidewater, part of the way over almost impossible roads.

Buy Missouri Mine in Montana

The Wandock Mining and Milling Co. of Minneapolis, represented by J. M. Wandock, A. G. Peters and V. D. Larson, has just purchased the Missouri mine near Virginia City, Mont., from the Elling Estates Company. It is reported that the purchase price was about $60,000. A ten-stamp mill and small cyanide plant were erected on the property in 1918. High-grade ore has been shipped.

Eureka, Utah, Ore Shipments Increased to 165 Cars

Tintic Standard Sends Out $64,000 Car —May Day and Uncle Sam Merged —Progress with Chief Mill

Tintic ore shipments for the week ended July 25 were 165 cars, or 29 more than during the preceding period. Recently the Tintic Standard mine shipped a car of silver ore valued at $64,000. The Zuma near this camp is to start prospecting by means of long-hole drilling, used at the Chief Consolidated. Eight inches of ore running well in lead and silver have been opened on the 880 level; this is considered to be the downward extension of mineralization found on the 800. Drifting is being done on the 1,000 level to catch the same ore.

The Sioux Consolidated is carrying on development through the Colorado shaft. Drifting will be started on the 1914 level of the latter mine for this purpose, and it will be necessary to do several hundred feet of drifting through Colorado ground before the Sioux can be reached. The May Day and Uncle Sam, two of the older mines of the district, are being consolidated under the name Mountain View Mining Co. The new company will undertake active development. Fred C. Dern, George Dern, J. C. Dick, Salt Lake City, and associates are interested. These men also controlled the May Day and Uncle Sam before the merger.

Good progress is being made with the construction of the Chief Consolidated mill and the flotation unit is about ready to start.

Lake Shore, With Enlarged Mill, Increases Profits

New Oreshoot in Wright-Hargreaves—May Add to Mill—Crown Reserve Wants Cash

The Lake Shore Mine Co., operating at Kirkland Lake, Ont., has declared a 5 per cent dividend payable Sept. 15. This would appear to put the company on a regular annual dividend basis of 20 per cent against 8 per cent paid for the last few years. At the present time the mill is treating 150 tons a day and this is gradually being increased, to an ultimate capacity of 300 tons a day. Production is now running at the rate of over $1,000,000 a year, if there is no diminution in grade with the increased tonnage. With the small mill the grade was approximately $24 a ton.

Underground development continues to be favorable. No. 1 vein which has been developed to the 1,000 level has an indicated average of about $12 over a width of 5 ft. On No. 2 vein, however, which is the main vein of the property, the grade is at least twice that of No. 1 and the width is considerably greater. In the crosscut on the 1,000 level two veins have recently been encountered which show approximately the same grade of ore as encountered on No. 2 vein at the 800 level. It is not known as yet which of these is the No. 2 vein, but this will be determined definitely as drifting makes progress.

An interim report has been issued by the Crown Reserve which shows that, during the month of June, a total of 550 ft. of development work was accomplished. This work has shown a better grade of ore than the average in the mine, as on the 425 ft. level the average has been $8.15 over a width of 8 ft. as compared with an average of $6.95 for the whole of the mine. The company is offering 1,000,000 shares to the stockholders at 60c.

At the Wright-Hargreaves property a new oreshoot recently found on No. 2 vein on the 1,000 ft. level has been opened up for a length of 167 ft. It is of higher grade than anything previously encountered in the mine and compares very favorably with the best ore found at any of the companies in the Kirkland district. Production at the present time is about $3,000 a day and it is expected that this fall the mill will be increased to approximately 400 tons a day.

At the Sylvanite property which lies between the Wright-Hargreaves and the Tough-Oakes and which is being developed by the Wright-Hargreaves interests, the shaft is down 1,000 ft. and development is being carried on at that depth.

Lead-Silver Ore in Granite Mountain Mine

According to A. G. Badger, president of the Belle Mining Co., work is being done on development of the Granite Mountain mine, situated in the Crazy Mountains in Montana. The recent development on the 1,000 level has opened some lead-silver ore. No shipments have been made.

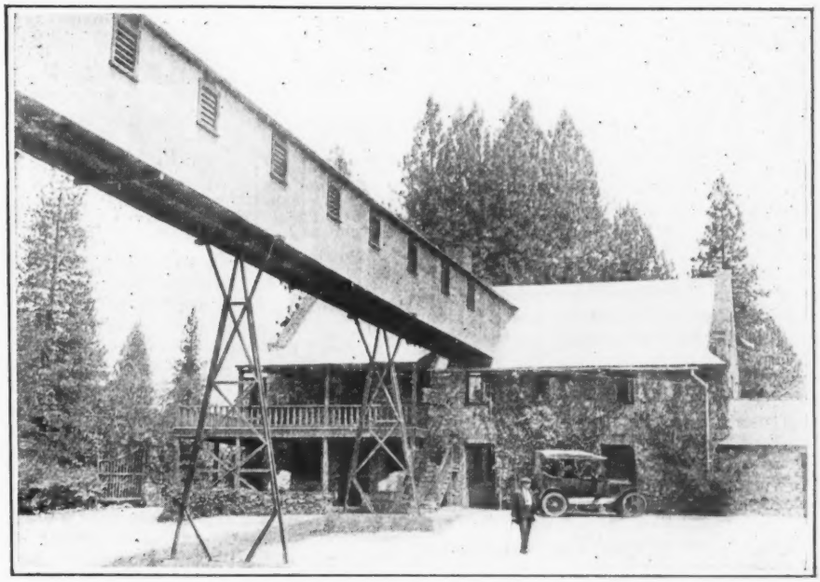
Tonopah Belmont Will Develop at Greater Depth

It is reported that the Tonopah Belmont Development Co. is arranging a five year lease on the property of the North Star Tunnel and Development Co., on a royalty basis, and will drive a crosscut under the North Star ground on its 1,500 level. This work will develop the North Star at a depth several hundred feet below the deepest North Star workings. The Belmont will also drive a crosscut into Jim Butler territory on the 1,500 level to develop that property at depth.

Consolidation Presages Increased Life For Empire Mines Co.

Grass Valley Interests Join—Sultana Group Adjoins Empire on South —Mill Burned in 1921

Announcement is made of a merger of the holdings of the Sultana Gold Mining Co. in Grass Valley, Calif., with those of the Empire Mines & Investment Co., whereby the latter concern will largely increase its reserves and prospects. Plans are under way for a comprehensive development scheme. The Sultana property adjoins the Empire on the south, and operations will be carried on from the 3,000-ft. level of the Empire. The consolidation will be an economical one from more than one standpoint, because the Sultana property is without a treatment plant, its 20-stamp mill, hoist, and power house having been destroyed by fire in 1921.



Office of the Empire Mines & Investment Co. at Grass Valley, Calif.

The Sultana group is a consolidation of the Orleans, Prescott Hill, Electric, Houston Hill, and Centennial companies. Production dates from the '50s. The present consolidation is owned by the Crocker family, of San Francisco. The Empire company is a closed corporation, controlled by the Bourn family, of San Francisco. Operations have been highly successful, from the financial as well as from the technical standpoint, in large measure on account of the ability and foresight of G. W. Starr, now managing director.

Rochester Forecloses $400,000 Debt of Candelaria

The Rochester Silver Corporation has filed suit for foreclosure of mortgage held by it on the property of the Candelaria Mines Co., in Nevada. The Rochester company advanced about $200,000 to Candelaria in 1921, and received notes aggregating $400,000, for mine development, mill construction and other purposes.

A 400-ton cyanide plant was constructed and put in operation, and a profit was realized during the period prior to the completion of the Pittman Act silver purchases. When silver dropped from $1 to 65c. per ounce the margin of profit was removed, and after several months of unprofitable operations the mine and mill were closed down. An effort was made to re-finance the Candelaria Mines Co. by the incorporation of a new company, called the New Candelaria Mines Co., which provided for an exchange of stock in the old company for stock in the new, plus 10c. per share. There was not a sufficient response by stockholders to finance the new company's operations and pay off the existing debts, and the plan appears to have been abandoned. After the failure of this plan the Rochester company refused to grant an extension of time on the mortgage and proceeded to foreclose.

Loring Secures Properties at Hamilton, Old Nevada Bonanza

The Silver King group of mining claims at Hamilton, Nev., has been secured by W. J. Loring and will be explored. The group consists of three claims and a fraction in the Treasure Hill area. The possibilities of the claims are not known at present but they will be thoroughly prospected.

News from Washington

By PAUL WOOTON
Special Correspondent

Federal Trade Commission Gives Views on Proposed Silver Export Association

"Mere Consequential Rise in Price" No Bar to Use of Statute, or Webb-Pomerene Act Would be Nullity—Views on Co-operative Action with Foreign Interests

IN ITS belated reply to the request of Secretary Hoover for information on points raised by those considering the possibility of a silver export association, the Federal Trade Commission has answered satisfactorily, it is believed, some of the points which were raised by the silver producers.

Much weight is given the pronouncements of the Federal Trade Commission in this connection, because of their significance to all industries concerned in the export trade. Credit is due Senator T. L. Oddie of Nevada, whose urgent letter of July 28 was directly responsible for the preparation of the answer by the Trade Commission. Senator Oddie states that the American Silver Producers' Association is under great obligations to the Commission for having expedited the work on the reply so that it could be presented at the Salt Lake City meeting on Aug. 6. Because of its far-reaching importance, the full text of the Commission's reply to the silver producers is presented in full as follows:

It seems to be open under the terms of the act, for those who desire to form an association under its provisions, to file with the Federal Trade Commission the declarations referred to in Sec. 5 of the Webb-Pomerene Act. The preliminary assent of the Commission to export association existence and activity under the act is not required. Effort was made at the time the act was passed to include in it the following amendment:

"Before any association shall engage in business under this act it shall secure from the Federal Trade Commission a permit to engage in such business, and said Commission is authorized to issue such permits and may, in its discretion, refuse a permit to any association, and may, after hearing, cancel any permit issued."

The omission of this amendment, together with the clear import of the act as passed, indicated that the action of the Commission towards export associations is corrective of action taken rather than a limitation upon the entry into action.

The Federal Trade Commission is, however, given control over the action of export trade associations, as will appear by Sec. 5 of the Act.

"Sec. 5. Wherever the Federal Trade Commission shall have reason to believe that an association or any agreement made or act done by such association is in restraint of trade within the United States or in restraint of the export trade of any domestic competitor of such association, or that an association either in the United States or elsewhere has entered into any agreement, understanding, or conspiracy, or done any act which artificially or intentionally enhances or depresses prices within the United States of commodities of the class exported by such association, or which substantially lessens competition within the United States or otherwise restrains trade therein, it shall summon such association, its officers and agents, to appear before it, and thereafter conduct an investigation into the alleged violation of law. Upon investigation, if it shall conclude that the law has been violated, it may make to such association recommendations for the readjustment of its business, in order that it may thereafter maintain its organization and management and conduct its business in accordance with law. If such association fails to comply with the recommendations of the Federal Trade Commission, said Commission shall refer its findings and recommendations to the Attorney General of the United States for such action thereon as he may deem proper."

It is entirely proper, therefore, that the Commission should, when called upon in advance of the formation of an export trade association, indicate that proposed lines of conduct would in its opinion, when carried into actual operation, invite the corrective attention of the Commission. But the Commission cannot assume the results of an indicated course of conduct. As appears from the statute itself, the test of legality lies in result in most instances, rather than in the form or method pursued. The Commission cannot always make a precise statement under these circumstances.

You will understand, therefore, that any preliminary expression is advisory only and that the committee which you represent is thereby in no way precluded from asserting any method or co-ordinate action which you believe to be within the intent and spirit of the act. If your views should differ from those of the Commission and the results accomplished should in its judgment fall within the scope of the prohibitions of the act, it would become the duty of the Commission to proceed to a determination of the issues involved in the manner provided by the act itself.

You ask,

"1. Do provisions of the Webb-Pomerene Act limit persons (natural or corporate) who may enter into such an association, to citizens of the United States or corporations formed under the laws of the United States or some state thereof?"

It seems that this question should be answered in the affirmative with possibly certain explanations. The Congress of the United States legislates with reference to the citizens of the United States and its sovereignty. Within the sovereignty of the United States are many who are not its citizens, but who are governed by its laws. The laws of the United States, therefore, are applicable to citizens of the United States, to those who are not citizens of the United States but are residents thereof, and to corporations formed under the laws of the United States or of some state within the United States.

It might be added that there is nothing in the act which prevents an association formed under it from entering into any co-operative relationship with a foreign corporation, for the sole purpose of operation in a foreign market. The only test of legality in such an arrangement would be the effect upon domestic conditions within the United States.

You ask,

"2. Is the export product that may be disposed of by such an association, limited to productions originating in and exported directly from ports of the United States, or does it also include products originating outside the United States, but thereafter imported into the United States and from thence exported to foreign markets directly from ports of the United States?"

The act is silent on this subject. In the absence of an indication to the contrary expressed in the act, the word "export" is assumed to include only domestic products and not the objects of import which form the basis of a subsequent export movement.

"2-a. Is the export product that may be disposed of by such an association limited to a product which is shipped from the United States, or may it also embrace a product of a member of the association produced outside of the United States, and shipped direct to a foreign port, without first entering the United States?"

It is difficult to see how shipment from a foreign port to a foreign port could be regarded as export from the United States. The first impression would be that much conduct would not come within the scope of the act.

You ask,

"3. Can a valid trade agreement be entered into between such export association (a) between nationals engaged in the production and exporting of commodities of commerce outside the United States, but whose product would reach the same foreign market as the product of the export association exporting such product direct from the United States; and (b) non-nationals engaged in the production and exporting of commodities outside the United States, but whose products would reach the same foreign market as the product of the export association exporting such product direct from the United States?"

The purpose of the act seems to have been to provide a method of eliminating competition in foreign markets among domestic producers. As stated above, there seems to be no reason why a Webb-Pomerene association composed of nationals or residents of the United States and actually exporting from the United States, might not adopt a trade arrangement with non-nationals reaching the same market, providing this market was not the domestic market of the United States and the action of this organization did not reflect unlawfully upon domestic conditions. It does not seem, however, that nationals and non-nationals who are also non-residents, might unite within the Webb-Pomerene association itself.

You ask,

"4. Must an export association under the act perform all the operations of selling its members' product to the foreign buyer, or does the word 'commerce' in the act mean that an export association complies with the act if it is solely engaged in allotting export orders among its members, or in fixing the prices at which its individual members shall sell any export trade, or in performing any one or more of the other operations comprised in the complete chain of operations that constitute selling and export trade under the general trade agreement that deals solely with export trade and as filed with the Federal Trade Commission, in accordance with the terms of the act?"

The act does not require that the association shall perform all the operations of selling its members' product to a foreign buyer. The limitation upon the methods of operation is to be found in the words "in the course of export." The Commission has recently passed upon the conduct of an association which does not itself export, but which performs a price-fixing function and an allocation of business, and sells at the wharf to others than the association, who conduct the export movement from that point. The position which the Commission takes is that the consummation sale within the United States if the product sold is intended for and actually is marked for and enters into export trade, is in the course of export within the meaning of the act. It would seem, therefore, that an association may, without necessarily involving conflict with the act, engage in allotting export orders among its members and in fixing prices at which the individual members shall sell in export trade.

The law provides two tests: One, that the conduct shall be in export or in the course of export. The second, that the conduct shall not be in restraint of trade within the United States, shall not restrain the export trade of any domestic competitor, and shall not artificially enhance prices or lessen competition within the United States, or otherwise restrain trade therein. The application of the second group of tests, of course, is dependent upon the results of conduct which cannot be forecast, at least by the Commission.

It may be noted that the papers filed by several associations show that the actual export and sale in foreign markets is conducted by the individual members.

You ask,

"5. Does the prohibition of the above act against affecting domestic commerce, extend to and include a consequential rise in price in the domestic market through the better organized control of the foreign markets and the broadening of export trade; or is such prohibition limited to acts which intentionally or directly are committed to advance the domestic price or restrain trade through an operation conducted merely in the guise of an export association?"

It is not within the purview of this act that the operations of a Webb-Pomerene association should become a device for betterment of a domestic market. Its sole purpose was the lessening of competition between domestic exporters in the foreign markets. It is exceedingly difficult to distinguish between a betterment of the domestic market expressed in a rising domestic price which is the result of the proper co-ordination of export to domestic consumption and a similar movement directed to the domestic market in which this result is directly and primarily intended through an adjustment of competitive relations in a foreign market. The law prohibits monopolistic effort or interference with competition by concerted action in the guise of a production of benefit to the public. It has been repeatedly stated that a beneficent purpose will not legalize conduct otherwise unlawful. The mere fact that there was a rising price in the domestic market would not be a controlling element. It is perfectly apparent that the proper adjustment of distribution may result in an increase in price in a glutted market and a decrease in price in one which is insufficiently supplied. Manifestly the arrangement must be devoid of any concerted curtailment of production or withdrawal from the domestic market of any part of its normal supply. It is well understood that an incidental or inconsequential effect upon domestic prices is not unlawful. If a merely consequential rise in price should bar American exporters from using this statute, the statute might become a nullity. The statute provides for a lawful course of procedure and if this procedure is followed and the statute complied with, merely indirect or consequential results cannot be held to be against the law. It is well settled, under the Sherman Act, that a contract which "only incidentally or indirectly restricts competition is not denounced by the act."

Million a Month Mine Wages in Joplin-Miami Zinc-Lead District

FROM reliable figures recently given out by A. M. Gaines, manager of the Premier mine at Picher, Okla., it is estimated that the mining companies of the Joplin-Miami district pay out approximately $1,000,000 a month for mine and mill labor.

The Premier in 1923 paid $140,147 for underground labor and $28,122 for mill labor, a total of $168,270. During the year it produced and milled 186,584 tons of rock, from which it made a mineral recovery of 4.62 per cent, or about 8,590 tons of mineral. The district's total output of mineral was about 650,000 tons, so the Premier's share was about 1/76 of the whole; and 76 times $168,270 gives $12,786,520 as the figure for the total payroll for ground and mill labor in this field, or slightly better than $1,000,000 a month.

It is to be noted that these figures do not include the expenditures for office help, nor for salaries for superintendents and managers. The average recovery for the Premier, 4.62 per cent, is considered somewhat lower than the average for the district, but offsetting this, in the computation, is the fact that many other mines have a higher per-ton labor cost, due to smaller and less efficient working forces and smaller working faces.

Ore Opened in Deeper Levels of Moscow Mine

Development at deeper levels in the Moscow mine—an old producer and dividend payer, near Milford, in Beaver County, Utah—is progressing satisfactorily. Work is being done on the 1,400, 1,450, and 1,100 levels in an effort to find the continuation of orebodies productive at higher levels and lost through faulting, and also to develop fissures that have hitherto not been prospected.

Work of the latter nature has opened 9 ft. of ore on the 1,450 level, averaging 45 per cent lead and 9 oz. silver. Development has been started on the 1,100 to find the upward extension of this new ore. The eleventh car of ore has been taken out in development work on the 1,100 and 1,400-ft. levels. The ore averages 17 per cent lead and 15 oz. silver. Developments at the Moscow are of interest both to the mine itself and to the district, where as yet very little development at depth has been done, but which contains prospectively attractive possibility for opening good oreshoots.

Two Companies Formed as Neighbors of Jib Consolidated

"Extension" and "Apex" Get Property in Basin District in Montana—Consolidated Milling 300 Tons Daily

The recent development work on a high-grade gold vein, and the continued improvement shown in milling operations at the Jib Consolidated property in the Basin district in Montana, have resulted in the formation of the usual companies to "take over" near-by claims with the purpose of profiting from the vogue of the original property.

Two new companies will start operating at once, according to the statements of California promoters who are now in Butte, after spending the last week at Basin properties. The new companies will be known as the Jib Extension and the Jib Apex.

Ralph E. Pearce, of Los Angeles, connected with Bryson & Co., who is at present in charge of the Jib Extension, says that a small crew of men will be started immediately in the shaft of the Last Chance, getting it in operating condition, and that by Aug. 15 a crew of fifty men will be employed. There are six other claims in the group held by this company, all of which lie east of the Jib Consolidated.

Irving Brock, Zeb Kendall, and Leo C. Paul are in charge of the Jib Apex, and according to Mr. Brock a "large force of men" will be started on development work immediately. This company has a group of six claims near the Jib Consolidated. Captain Owen F. Brinton, general manager of the Jib Consolidated, has been made general manager by the promoters of the Jib Apex Company.

More than 200 men are employed at the Jib Consolidated at the present time. The net returns for June were $52,000, and it is expected that they will be more than $80,000 net for July. The company is milling about 300 tons of ore per day, and holding the mill heads between $25 and $30, largely in gold.

Calumet & Hecla Will Explore Old Cliff Lands

Data from Recent Geological Survey Will Be Used—Scientific Prospecting Will Be Possible

Geological facts established by a special corps of geologists for Calumet & Hecla Consolidated will be applied in the proposed exploration of the Cliff lands of the company in Keweenaw County, Michigan, copper district. Certain conditions associated only with commercial native copper deposits will be the guide in exploratory procedure. It will be the first application of these principles in lands apart from producing areas. Diamond drilling was done in Cliff lands in connection with the geological survey in progress the last four years, and on the strength of conditions noted an exploration of the property was recommended.

Data at hand will be of great value in the work not only in Cliff territory but wherever undertaken in tracts owned by C. & H. The most likely copper bearing areas have been defined and the survey will be the means of saving many thousands of dollars in the opening of new mines. The Cliff is considered a most hopeful field and development of another producer in Keweenaw would have an important bearing on the future of mining in that part of the district.

The old Cliff operated exclusively on a fissure vein, which proved profitable, but with the exhaustion of the copper and silver in that formation the mine was abandoned. The Cliff carries numerous amygdaloidal beds, but the most promising, and the one on which Calumet will center its attention, is the Kearsarge. Conditions revealed apparently point to the presence of commercial deposits in the lode and Calumet's intention to thoroughly explore the property is of particular interest to those who never have lost confidence in "old Keweenaw."

Barnsdall Zinc Co. Will Drill Oklahoma Leases

The Barnsdall Zinc. Co., which heretofore has confined its activities in this field to operations near Waco, Mo., has recently taken a drilling option on the Right Good mine and lease, south of Hockerville, Okla., and has placed a number of drill rigs on the tract.

The Right Good property is owned by the Meteor Mining Co. and W. Glidden, of Clay Center, Kan. The Barnsdall Co. has recently repaired its No. 1 mill, in the Waco camp.

Possible Disaster in Hecla Mine Averted by Prompt Action of Fire Crew

A WATCHMAN in the Hecla mine in the Coeur d'Alene district in Idaho early in the morning of July 20 discovered fire in a raise connecting the 900 and 600 levels in the "east" orebody. This being an off Sunday, there were no men in the mine except the watchmen and pumpmen. Three crews of helmetmen, employees of the Hecla, were quickly ready for duty, the rescue car owned by Coeur d'Alene operators was rushed to the mine from Wallace, and Karl T. Sparks, superintendent of rescue work for all the mines of the district, was summoned to direct the work of controlling and extinguishing the fire.

The raise was soon being deluged with water by hose from below and by turning drainage water from the levels above. By Sunday evening investigations showed that the fire was being confined to the raise and that it was only a question of time when it would be extinguished, and that gas would be confined to the workings above the 1,200 level. In that situation, all employees on the 1,600 level and 2,000 reported for work Monday morning the same as usual. Tuesday the mine had been practically freed of gas, which permitted resumption of operations on the 1,200, and Wednesday work was resumed in the upper workings. Thus through having well trained and thoroughly equipped helmetmen in readiness for service, the Hecla company controlled and extinguished the fire without injury to an employee and without interfering with usual production. What the consequences might have been had this "insurance" not been provided can only be surmised.

Two Development Projects Started in El Tigre District

E. H. Devore of Douglas recently located the old Cuatro Amigo mine in the El Tigre district. A company has been organized and it is planned to start development at once. Considerable work was done on the property about twenty years ago and a large vein of milling ore was opened containing gold and silver. If sufficient ore is blocked out to justify the installation of a mill, construction will be started. Adjoining the Cuatro Amigos on the south is the Mancha claim recently denounced by N. D. Shippy. He has been prospecting the El Tigre range for thirty years and had camped within a stone's throw of the vein on the Mancha ground. He had walked over the place years ago where he has now uncovered a large vein averaging 5 oz. gold per ton.

Trinity Dredging Co. Will Rebuild Boat at Lewiston

The Trinity Dredging Co., which has operated a gold dredge on the Trinity River, above Lewiston, Calif., for a number of years, will reconstruct the dredge during the summer. A new hull will be built and improvements made in the machinery of the dredge. H. E. Chesbro is president of the Trinity company.

Custom Mill East of Nacozari, Mexico, Will Help District

Loeven and Armstrong Install Ball Mill to Effect Fine Grinding—Near Old Pittsburg Mine

Messrs. Loeven and Armstrong are engaged in installing a new ball mill at their mill at the Rebaje, about six miles east of Nacozari, Sonora, Mexico. The mill is near the old Pittsburg and Muralla mines, and is near the center of the gold-silver belt that includes the mines of the Churunababi, San Jose, Vaquero groups as well as those of El Globo, La Mexicana, and Crestonsus Oro. Previously the Loeven mill, invented by Mitt Quinner and improved by Harry Loeven, had been installed, but was found to be inefficient for the fine grinding necessary to good extraction. It will now be used as a preliminary grinder and will serve the purpose of increasing the tonnage treated.

The ball mill is being made in Nacozari by Herman Littlewood, having been patented by him. Loeven and Armstrong have denounced a claim to the south of La Mexicana and are doing development work. They plan to run a custom mill and should have no trouble in getting plenty of ores suitable for treatment. The operation of this mill will fill a longfelt want in this district, where most of the ores are too low-grade to mine and ship at a profit.

Silver Wave Will Resume Mill Operations in Utah

The summer season has inaugurated increased activity in American Fork Canon, in Utah, where the haulage conditions, owing to the altitude and steep grades, are hampering. The Silver Wave mine, operated by the American Leasing Co., and the adjoining Globe property, as well as the district in general, will be greatly benefited by the completion of the new road from Dutchman's Flat. This will make it possible to drive by automobile directly to the Silver Wave, and will make possible increased shipments.

The Silver Wave is mining both shipping ore and milling ore. As soon as the road is completed operations at the mill will be resumed. At the Globe Consolidated an effort is being made to find the continuation of the Silver Wave orebody. Conditions are stated to be promising, and the ground shows mineralization. Assays of gold, silver, and copper have been obtained.

Calumet & Hecla Has $50,000,000 Lb. Copper in Stock

Calumet & Hecla Consolidated, Michigan copper district, has close to 50,000,000 lb. of copper on hand, which is better than seven months' production at the current rate of operations. This represents metal produced by the conglomerate department, reclamation plant, Ahmeek and Isle Royale. The company's sales have been at the average rate of 5,500,000 lb. per month during the last quarter. Due to the advance in the price of the metal, the company's stock of copper has increased nearly $500,000 in value since July 1 of this year.

Days Acquire Control of Gertie Company in Idaho

Will Use Long Tunnel to Explore Maher-Hearn Claims—$75,000 Involved

The Day interests, in the Coeur d'Alene district of Idaho, have bought control of the Gertie Mining Co. from L. W. Hutton on a basis of 3c. per share; they agree to take all other stock offered at the same figure. This means a valuation of $75,000 for the property, as the company is incorporated for 2,500,000 shares. The Gertie owns two claims and a fraction east of and joining the Hecla, near Burke, Idaho.

On the theory that it had the extension of the Hecla vein, the company, financed mainly by Mr. Hutton, drove a crosscut tunnel about a mile in length, but which failed to find the Hecla vein. Nothing has been done on the property for several years. While the long tunnel failed in its purpose, it nevertheless provides the key for the development of the Maher-Hearn group of twenty-seven claims east of the Gertie, owned by Harry L. and Jerome J. Day, Mrs. Edward Boyce and the estate of the late E. R. Day. The purpose in securing control of the Gertie is to obtain this crosscut tunnel for the development of the Maher-Hearn property, which it is presumed will be turned over to the Hercules Mining Co. within the next few months.

Inspiration Will Get Power from Horse Mesa Dam

The shareholders of the Salt River Valley Water Users' Association of Arizona voted twenty to one at a recent special election in favor of issuing bonds for the purpose of financing the Horse Mesa power development project. Plans call for the erection of a dam at Horse Mesa, which, together with transmission lines and generating machinery, will cost considerably more than $4,000,000.

The Inspiration Consolidated Copper Co. has contracted for all power that will be generated, for which that company has agreed to pay at least $565,500 annually for a period of fifteen years. With the construction of the 7,500-ton leaching plant and the completion of other large developments that have been under way at the Inspiration property it is likely that power consumption will exceed even that amount within a few years.

Will Develop Gold Basin Mine Near Fairview, Nev.

Plans are about completed for the starting of development work on the property of the Gold Basin Consolidated Mining Co., at Gold Basin, near Fairview, Nev. The company is planning to sink a 200-ft. vertical shaft and do lateral work at that depth. The district gives promise of important discoveries, as there are several quartz veins which contain ore, and placer gold has been known for many years in the gulch below the property owned by the Gold Basin company.

Lessees Do Well in Tom Reed and United Eastern

Lessees operating the Tom Reed mine, at Oatman, Ariz., have been treating about 25 tons per day at the mill since the company ceased operation of the property. Lessees are also operating at the United Eastern property, where work by the company also ceased a short time ago, and their tonnage is expected to increase the total that is now being treated at the Tom Reed mill.

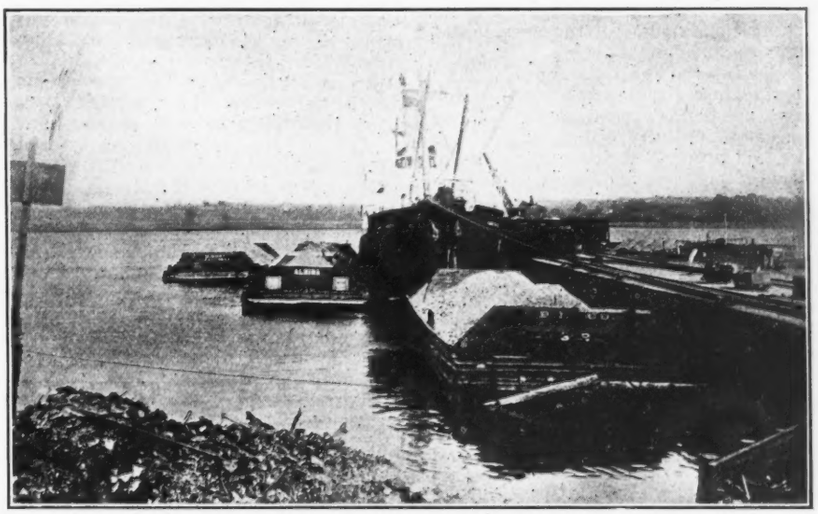
A recent clean-up netted 1,611 oz. of gold, which was shipped to the mint by parcel post. Other leases are being granted and it is expected that the tonnage will soon be much larger.

More Rich Silver-Lead Strikes Near Keno Hill

A rich strike of silver-lead ore has been made on Galena Hill, in the Keno Hill district, Yukon. The strike was made on claims owned by W. E. Thompson and R. Fisher, and the assays are said to average more than 700 oz. in silver per ton and 60 per cent of lead.

Frank Gillespie, a prospector who has just returned from the new Beaver district, 50 miles northwest of Keno Hill, reports the uncovering of an 18-ft. orebody, assays from which run between 60 and 70 per cent of lead and 30 and 40 oz. of silver.

The Treadwell interests are proceeding with plans for a concentrator.



Ore dock at Chrome, N. J., at the copper smelting and refining plant of the U. S. Metals Refining Co.

Colorado Fuel & Iron Co. Buys Colorado Fluorspar Properties

Wagon Wheel Gap Mines Purchased—Independent Producers Must Look for New Market

Negotiations which have been under way for several months for the purchase of the fluorspar properties of the American Fluorspar Co. at Wagon Wheel Gap, in Mineral County, Colorado, by the Colorado Fuel & Iron Co., were completed the latter part of July and final payment and transfer of the property has been made.

Operations on the property were commenced in 1912 by Shrive B. Collins, who with Wallace Leary developed the property into one of the largest fluorspar producers in the West, the output going chiefly to the steel plant of the Colorado Fuel & Iron Co. with lesser shipments to eastern steel plants, at times as far East as Birmingham, Ala.

With the sale of the mineral land to the C. F. & I. a sale also was made of adjoining property which together netted the owners approximately $300,000. The Colorado Fuel & Iron Co. prior to the purchase of this property has been the market for fluorspar ore, which is produced also in Boulder and Jackson counties, but by the sale of the Wagon Wheel Gap mines it is believed that as soon as present contracts expire, Boulder and Jackson county producers will be forced to find a market for their product outside of the state.

During recent months scouts for eastern dealers or consumers have visited the producing districts investigating conditions affecting production and possible output and with a revival of activity at the steel mills Colorado fluorspar miners anticipate a good market for their product.

Argentine Finds Galena in "Dry-Ore" Belt

The discovery of about seven inches of high-grade galena in drifing from the bottom of a 200-ft. shaft by the Argentine Mining Co. has created considerable interest in the Coeur d'Alene district in Idaho. The Argentine is an old property from which quite extensive shipments of gray copper ore have been made, being located in what is popularly known as the dry-ore belt. The discovery of this galena shoot at the bottom of a shaft sunk 200 ft. from the main tunnel indicates that lead-silver ore may predominate in the deeper workings. The lead-silver ore has been drifted upon about 50 ft. and gives evidence of being the beginning of an important oreshoot.

Mexico Letter

By Our Special Correspondent for Northern Mexican

Election Concluded Without Bloodshed, Mining Picks Up

American Capital Reassured—Activity in Durango and Chihuahua—A. S. & R. Negotiates for Mines

Monterey, June 20 — Now that the Presidential election has passed without a recurrence of revolutionary outbreaks, a renewal of mining activities in the various districts of northern Mexico has already started. In many instances investments of American capital in mines which were held up pending the outcome of the Presidential campaign are now being concluded. Prospecting also is becoming more general than for several years. New claims are being opened, and machinery and equipment are being installed in many old properties, according to information from neighboring mining districts.

Exploitation of a group of iron mines in the Sierra Mercado, State of Durango, will be started soon by the Compania Fundidora de Acero of Monterey. This company recently acquired title to the mines. They are said to contain a large quantity of reasonably high-grade iron ore.

In the Otaez district, State of Durango, La Esperanza group of silver mines has been acquired by the Bacis Gold & Silver Mining Co. It is said that development of this property on a large scale will be started as soon as the necessary equipment can be installed.

The Peñoles Mining Co. recently purchased several producing mines in the Santa Eulalia district, near the city of Chihuahua, and in the Santa Barbara district. Early in June the Peñoles company took over the Mosqueteros mine, at Los Lamentos, State of Chihuahua. It has struck a body of ore in the mine which assays 47 oz. silver per ton and 40 per cent lead. Machinery and other equipment are being installed.

Salvador F. Munoz, mining engineer of Juarez, is preparing to start development work upon a group of thirty-five claims, situated in the Colorado Mountains, State of Chihuahua.

Regular shipments of gold, silver, and copper ore from the Esperanza group of claims, in the Guadalupe y Calvo district, State of Chihuahua, will be started soon, according to Edward H. Hicks, who recently acquired title to this property. He also purchased the Leonila group of claims, situated on the San Miguel ranch, State of Durango. He will proceed with the development of these claims immediately, it is reported.

José Maria Rico has purchased a group of partly developed claims in the Dolores district, State of Chihuahua, and is taking out good ore.

Negotiations are still pending, it is said, for the purchase of Blanca y Anexas mines, situated in the State of Oaxaca, by the American Smelting & Refining Co. An examination of the property by a representative of the company was made several weeks ago with a view to its purchase.

Three Gold Dredges and Several Mines Operate in Oregon

Cornucopia Produces 75 Tons Daily—Bay Horse Ore Being Tested—May Remodel Mill

Three gold dredges are now being operated in Oregon, one at John Day, by the Empire Gold Dredging and Mining Co., the second on the Powder River below Sumpter, by the Powder River Dredging Co., and the third south of Baker City, by the Superior Dredging Co. of Salt Lake.

In Eastern Oregon, the Cornucopia Mines Co. at Cornucopia has been operating during the past year, producing from 60 to 75 tons per day. The Iron Dyke at Homestead and other properties in the vicinity have slowed down; some have shut down and others are doing only exploration and development work.

The Baisley-Elkhorn near Baker was recently unwatered and the mine was examined by Milnor Roberts. Ores of the Bay Horse mine on Snake River, 10 miles below Huntington, are being thoroughly tested with a view to changes in mill practice. The Ibex near Sumpter is being developed in a small way and awaiting the completion of a power line to its properties. The Sumpter smelter has been closed down and will probably not operate.

A smelter is being promoted at Gold Hill, Oregon, and efforts are being made by the Southwest Oregon Mining Bureau to interest mine owners in the project.

Ore in Whitewater Mine

The Whitewater mine, at Slocan, B. C., is expected to become a producer. Since the resumption of development some promising bodies of ore have been opened. Silver ore is being taken from a stope above No. 2 level and a considerable body has been uncovered above No. 5 level, of which 45 tons recently were shipped to the Trail Smelter. Two feet of ore, assaying 40 per cent lead and 80 oz. silver, is being opened up above the No. 9 level, and further development is planned on the 12th and 13th levels.

Johannesburg Letter

By John Watson

Special Correspondent

Rand Gold Output for May Second Best in History

Government Areas Registers Big Increase—Many Dividends—Range Up to 60 Per Cent

Johannesburg, June 30—The output of the Transvaal gold mines for May was declared as 809,003 oz., having a value of £3,822,539. Compared with April, there was an increase of 40,080 oz., equal in value to £218,213. The above figure has only once been exceeded — in March, 1912 — when a special clean-up of plant was made all along the reef, owing to unsettled industrial conditions. May had twenty-seven working days and the average daily output was 29,963 oz., whereas last March a daily average of 30,603 was attained. Among the most notable increases in May, Government G. M. Areas had 6,905, Crown Mines 3,181, and New State Areas 3,165 oz. over their respective April figures. The native labor returns show 172,586 "boys" employed on the gold mines at end of May, which is a decrease of 436 during the month.

The following dividends for the half-year have recently been announced:

Company	Dividend No.	Rate Per Cent	Rate Per Share
City Deep	24	25	5s per £1 share
Consolidated Main Reef	30	6¼	1s. 3d. per £1 share
Crown Mines	46	40	4s. per 10s. share
Durban R. Deep	18	5	1s. per £1 share
Geldenhuis Deep	44	5	1s. per £1 share
Modder "B"	24	60	3s. per 5s. share
New Modder	36	50	5s. per 10s. share
Nourse Mines	38	3¾	9d. per £1 share
Rose Deep	46	11¼	2s. 3d. per £1 share
Village Deep	29	5	1s. per £1 share
Brakpan Mines	24	20	4s. per £1 share
Springs Mines	10	15	3s. per £1 share
Rand Mines	42	60	3s. per 5s. share
Government G. M. Areas	14	32½	6s.6d. per £1 share
Langlaagte Estate	66	7½	1s. 6d. per £1 share
Van Ryn Deep	22	30	6s. per £1 share
Sub-Nigel	23	5	1s. per £1 share
Robinson Deep "A" shares	10		6s.
Witwatersrand G. M.	40	12½	2s. 6d. per £1 share
Witwatersrand Deep	31	7½	1s. 6d. per £1 share
Leeuwpoort Tin	8	5	3d. per 5s. share
De Beers Consolidated Mines	..	..	10s. on preference shares
De Beers Consolidated Mines	..	..	10s. on deferred shares

Nipissing Drops Powell Option in Rouyn Township, Que.

The Nipissing Mining Co. of Cobalt, Ont., has given up its option on the Powell property in the Rouyn district of Quebec. The Powell property is owned by the Noranda Mines, Ltd., and a substantial payment was due on Aug. 1. The Nipissing sank a shaft to a depth of over 200 ft. and did considerable work on two levels. The grade of ore found, however, was not sufficiently good to justify the payment to be made and the option was allowed to lapse.

The Noranda company is continuing work on its Horne property where diamond drilling and trenching have indicated deposits said to contain upward of $7,000,000 in gold-copper ore averaging $20 per ton. Transportation is a need of the district, but this will undoubtedly be provided if the development of the orebodies is sufficiently promising to warrant it.

London Letter

By W. A. Doman
Special Correspondent

American Copper Company Would Like to Buy Into Katanga

Rumor Says So in London—Dividend Increased from 35 Francs to 80 Francs

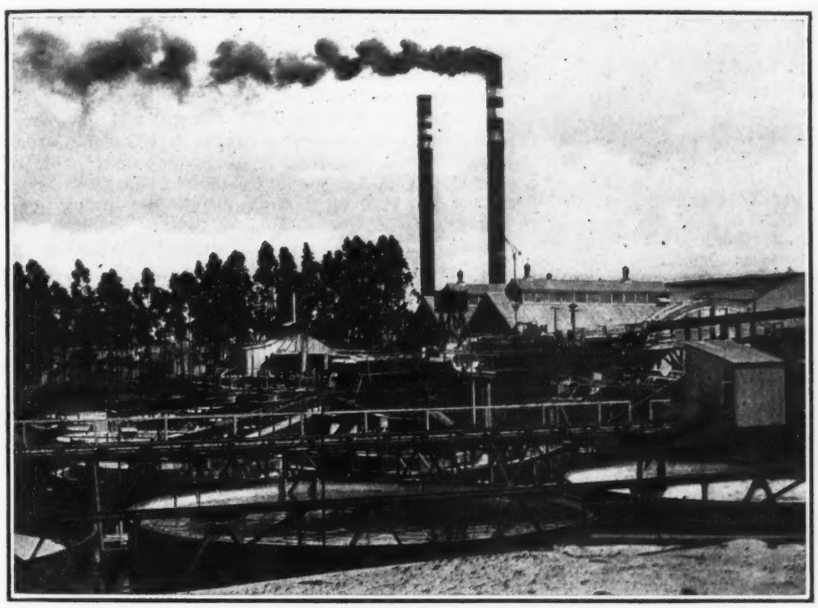
London, July 21—It was only to be expected that, with the improving copper output, the profit of the Union Minière du Haut Katanga in 1923 (in which the Tanganyika Concessions holds such a large interest) would be greater than during 1922. At the meeting held last week it was stated that the divisible profit amounted to 51,000,000 fr., against an available balance of 20,200,000 fr. for the preceding period. The value of the Belgian franc has, of course, varied considerably during the period, being at the end of 1922 about 54 to the English pound sterling, and at Dec. 31 last it was over 96 to the pound sterling. The dividend has been raised from 35 fr. to 80 fr., and the company carries forward a balance of 4,500,000 fr.

Large as the ore reserves have always been, the position is now even more satisfactory, as they aggregate 72,650,000 tons, estimated to contain 4,800,000 tons of copper. A rumor has been current that one of the large copper companies in America has its eye on the Union Minière and will endeavor to secure an interest. At today's prices the market value of the Tanganyika Concessions' holding in Union Minière shares alone is in excess of £7,000,000.

William H. Trewartha-James, of James Bros., consulting engineers, London, intends leaving for Canada within the next fortnight. I understand he will represent a syndicate and proposes going over various properties that have been offered, and will also endeavor to discover others that might with advantage be tested and brought before the British public.

Some months ago I mentioned that the Northern Exploration Co., which is operating a property in Spitzbergen, was not in the most comfortable position and that further capital was essential to prove certain properties. Even the coal which does exist is not being worked to the fullest possible extent, as shareholders did not subscribe the financial support which it was hoped they would give. The directors have entered into an advantageous arrangement for the opening up of the zinc deposits. They have further endeavored to dispose of a part of the properties and to arrange a loan from the government through the Trade Facilities Committee, but have not met with success. Spitzbergen at the moment does not seem to be in very great favor. The company is to be reorganized, and it is proposed to write down the issued capital from £1 shares to shares of 2s. 6d., each, the balance, 17s. 6d., being either lost or unrepresented by available assets. At a later date further shares with a nominal value of 2s. 6d. each are to be issued.

I understand that Hugh F. Marriott has been appointed consulting engineer to a company that intends to investigate a silver-lead and zinc proposition in Far Eastern Siberia. The concession, besides containing these metals, is also reported to have deposits of gold and coal. In the first place, an examination is to be made of the silver-lead and zinc proposition. The property is not so far from civilization as may appear on the surface, as in the event of the ground being capable of profitable development, it is more than probable that Japan might take the whole of the output of the lead and zinc, there being a big field both in Japan and China for these metals. Both countries now receive a certain quantity from the Broken Hill Mines, in Australia.



Cyanide tanks at the Robinson gold mine, on the Rand in South Africa

Melbourne Letter

By Peter G. Tait
Special Correspondent

Ivanhoe Gold and Lake View & Star Reach Agreement

Lake View Mill Expansion To Be Financed—Lake Way Prospecting May Prove Important

Melbourne, June 27—According to advices from London, the Ivanhoe Gold Corporation, of Kalgoorlie, has come to an arrangement with the Lake View & Star company by which the latter takes over all its property, leases and rights for 500,000 fully paid shares of 4s. each. The Ivanhoe company also agrees to contribute £20,000 to enlarge and improve the Lake View mill. With the higher costs ruling during recent years it was a foregone conclusion that such amalgamations would come about. During 1923 the Ivanhoe mine produced 148,036 tons, for a yield of 58,624 oz. of gold, and after debiting all charges there was a loss of £5,000.

H. E. Vail, the local superintendent of the Lake View & Star Co., went to London some time ago, presumably to advise the directors in regard to the proposal now consummated. The company has good prospects on several of the leases which it holds on the Kalgoorlie field, and although the Ivanhoe mine may no longer justify its operation as a separate concern, it will probably still pay the Lake View & Star Co. to work it so as to augment the total tonnage available for treatment from its own Lake View, Chaffers, and other leases. If the prospecting work carried out by the Ivanhoe company on the Gwalia Consolidated leases at Wiluna in the Lake Way district proves satisfactory, the Ivanhoe company will probably transfer its sphere of operations to that district. Up to the present, however, no information is forthcoming regarding the results of the bores. It will be recalled that the Western Australian Government has agreed to construct a line of railway to this field if the bores prove the tonnage and values believed to exist and provided the Ivanhoe company undertakes to spend £300,000 on the property.

Australian Gypsum, Ltd., a New South Wales company, operating in South Australia, has been resurrected with a capital of £400,000 for the purpose of mining, manufacturing, and dealing with plaster of paris, salts, and manures. For the year ended Dec. 31 last, the company made a net profit of £15,437. The gypsum deposits in South Australia have been extensively worked to meet local requirements. This company's property is connected by a light railway from Penang to the shipping port at Cape Thevenard.

The Australian Minerals Recovery Co., which controls the metallic contact process, reports that the Western Australian government, which recently carried out some experiments with the process on ore from the Ravensthorpe field, has agreed to advance £4.000 to the Copper Separation, Ltd., for the purpose of erecting a plant on the field.

Situation at the Mines

By Arthur B. Parsons
Assistant Editor

THE miner of silver, copper, lead, and zinc usually markets his output from day to day on a quotation that is subject to comparatively wide and rapid fluctuations. At the same time he can, and frequently does, vary his rate of production to suit the market. As a consequence it is only necessary to glance at the quotations for the metals as printed in the *Mining Journal-Press* to arrive at a fair general answer to the question "What is the situation at the mines?"

Silver recently reached a new high for the year, 68¼c.; ergo, silver output is high and silver districts are prosperous. The same is true of lead producers. Though the current market of 7.5c. is considerably below the 9c. of March, it is an improvement over the early part of July and is high enough to stimulate output. The zinc market has also strengthened slightly to 6.05c. and production in the Joplin-Miami field has increased despite the efforts on the part of some operators to hold it down. Even the slight increase in copper from 12.25c. to 12.875c. has encouraged some of the small producers to accelerate their production.

Just how the aggregate current copper production compares with that of recent months is hard to say, particularly in view of the avowed intention on the part of dominant interests to conceal the figures. A good guess is that the total, including foreign and domestic, is about 10,000,000 lb. less than it was in the early months of the year. Government figures for June show nearly 127,000,000 lb. domestic mine production, a decline of 4,000,000 compared with May, and of 7,000,000 compared with January. Moreover, the drop in foreign production is important, so that the current rate is undoubtedly considerably lower than it has been.

Perhaps the most significant drop is in the rate of Utah Copper's production. Neither the Magna nor Arthur plants is running at full capacity, and it is likely that the output is much less than the 19,500,000 lb. with which the company was credited a few months ago. It looks as though Kennecott, which controls Utah, had decided to cooperate with Anaconda in the effort to better the copper situation.

Another big slice from world production will accompany the reported curtailment of Cerro de Pasco to about 3,000,000 lb., from 6,500,000 lb. in recent months and a maximum of 10,000,000 since the new smelter was started. Chile, with 16,000,000; Anaconda, with 15,000,000; Inspiration, with 6,500,000; and Calumet & Hecla, with 5,500,000—all estimated—are presumably maintaining the decreased rates established in May. Howe Sound, in British Columbia, is a recent recruit to the ranks of the curtailers, and the latest statistics of Alaskan shipments show about 6,000,000 lb. monthly, which indicates diminished production by Kennecott and Mother Lode. East Butte suspended operations at both mine and smelter on Aug. 1, thereby cutting 500,000 lb. from the monthly total.

On the other hand, United Verde in July produced nearly 10,000,000 lb., which establishes a new high record for that company. The completion of a new crushing plant at the smelter probably accounts for the gain. Ohio Copper has increased further, the figure for June being 1,200,000. Magma, with its new smelter is making 3,000,000 lb. per month; and in Africa the Katanga output for June was just under 16,000,000 lb. an increase of 2,000,000 lb.

Indicative of the faith of the copper producers in the future are new construction projects. The Inspiration Consolidated will build a new $6,000,000 leaching plant at Miami, Ariz.; and preliminary large-scale tests are being made by the United Verde Extension at the Humboldt reduction works, in anticipation of building a large concentrator at Jerome. Calumet & Hecla, in Michigan, is proceeding with the construction of a new 9-mile standard-gage railroad between the Ahmeek mine and mill.

Little change is to be noted in lead-mining operations. The St. Joseph Lead Co. is mining and milling about 15,000 tons of ore per day in the Flat River district, for a monthly output of 30,000,000 lb. of metal. This looks like a record for production by one company in a single group of mines. Lead smelters in Colorado and Utah are handling a smaller tonnage than they were two months ago, because at that time they were smelting the accumulation of ore that the 9c. lead market brought them. The present rate of mine output is a little better than it has been. In Utah, the Tintic mines shipped 165 cars of ore during the last week in July, a new high record for 1924. The Chief Consolidated milling plant is nearing completion, and the flotation department is virtually ready to start. This should help metal output, though the tonnage going to the smelters may be decreased. Mines in the San Juan district, in Colorado, are producing at capacity, shipping concentrate to both Durango and Leadville.

Perhaps the most prosperous district in the West is the Cœur d'Alene, in Idaho. The Bunker Hill has recently put a new sampling plant and a new Cottrell treater in operation at the smelter, and the Hecla is rapidly completing one of the largest and most modern mine plants in the country. Shipments of lead ore and concentrate are estimated at 23,000 tons per month. A number of development projects are under way, one being the extension of the Horseshoe tunnel by the Atlas Mining Co. Other producing lead mines, tributary to the Coeur d'Alene district, include the Gladstone, Santa Rita, Idaho Continental, Chloride Queen, and Old Dominion.

The good silver market is an important factor in the operations of these Western lead mines, as nearly all the ores have high silver content. Tonopah, Nevada's premier silver camp, is thriving. New discoveries in the extreme western portion of the district indicate a large increase in the productive area. New work is planned by the Tonopah Belmont company under the North Star and Jim Butler workings, and the Tonopah Divide has absorbed the Tonopah Midway, on the development of which it will spend some of its idle funds. The new 200-ton flotation plant of the Flowery Comstock, near Virginia City, has been started. The Tonopah Mining Co. is reopening sundry old bonanza silver properties at Hamilton, Nev. Something more than a coincidence is the shipment of a $60,000 car of silver ore from the Tintic Standard mine, in Utah, at the time silver reached 68¼c.

Zinc producers in the Joplin-Miami district are busy but uncomfortable. Output has increased in the last week or two to about 12,500 tons of 60 per cent zinc concentrate, which is fully equal to current sales. Stockpiles are of considerable size, and it is feared that the improved prices cannot be maintained if production is increased. Concentrates shipped from the Coeur d'Alene district during the month contained about 1,500,000 lb. of zinc, and the output from Butte, represented by Elm Orlu, Butte & Superior, and Anaconda, totaled about 7,500,000 lb.

The iron-mining situation is not bright. The Cleveland-Cliffs Iron Co., one of the largest independents, has placed all but one of its mines on a 4-day basis.

Gold mining continues to thrive. Cripple Creek, Colo., mines are finding good orebodies in their development work on the new levels. The Portland has just started hoisting through the Independence shaft and will increase output. In the Oatman district, in Arizona, both the Tom Reed and United Eastern mines, at which company operations were recently discontinued, are being worked successfully by lessees. Gold output from the Porcupine mines, in Ontario, is increasing as a consequence, principally, of higher mill heads at the Hollinger, where 5,000 tons of $9 ore is being cyanided daily. The Lake Shore, at Kirkland Lake, is increasing output in its enlarged plant.

In British Columbia, the Consolidated Mining & Smelting Co. continues to produce from its Sullivan mine about 25,000 tons monthly of concentrates, part lead and part zinc. The company has announced a program of enlargement at its Trail reduction works.

One thing regarding which ideas are unanimous is the labor situation. There seems to be no shortage of workers anywhere, and the cry of inefficiency and lack of competent underground miners is little more than an echo of what was heard last spring.

Men You Should Know About

Lester W. Strauss left New York for Valparaiso, Chile, on Aug. 7.

Arthur Keith is engaged in field work in New England for the U. S. Geological Survey.

J. T. Pardee is doing geological work on the phosphate deposits near Phillipsburg, Mont.

J. W. Sherwin, general manager of the West End Consolidated Mining Co., is in Tonopah from Oakland.

C. A. Heller, of Philadelphia, president of the Tonopah Belmont Development Co., was recently in Nevada.

E. F. Burchard, of the U. S. Geological Survey, has returned to Washington after an extended western trip.

Arthur W. Jenks, metallurgical engineer, recently returned from Sonora, Mexico, to his home in Berkeley, Calif.

John D. Ryan, chairman of the board of the Anaconda Copper company, has been visiting the Michigan copper district.

John G. Kirchen, general manager of the Tonopah Extension Mining Co., has returned to Tonopah from San Francisco.

Fred E. Turner, mine superintendent of the Ohio Copper Co., in Bingham Canyon, Utah, is in New York for a short visit.

H. A. Wheeler has returned to St. Louis from Durango, Mexico, where he examined mining property for American clients.

H. A. Johnson, superintendent for the Tonopah Mining Co. at Tonopah, has returned to Tonopah from a business trip to San Francisco.

R. W. Brigstocke, mining engineer, of Toronto, is making an examination of the Stabell property, in the northwestern Quebec mining area.

James G. Ross, consulting mining engineer of Montreal, is making an examination of the Don Rouyn property, in the Rouyn field.

L. S. Cates, general manager for the Utah Copper Co., has been enjoying his first vacation in fourteen years. He went to British Columbia.

F. B. Weeks, who is developing a mining property in the old Calico district of San Bernardino County, Calif., is in San Francisco on a short visit.

A. G. McGregor has arrived at Inspiration, Ariz., where he will start design of the new leaching plant that will be erected by Inspiration Consolidated Copper Co.

Charles A. Randall has been appointed manager of the Goudreau gold mine, in the Algoma district of Ontario, and has completed plans for the erection of a 150-ton mill.

William G. Wilson, superintendent of mills, and **George D. MacDougall,** chief mechanical engineer, of the British Empire Steel Corporation, have resigned their positions.

William J. Loring will be the chairman of the gold producers' conference to be held at the American Mining Congress convention at Sacramento, Calif., Sept. 29 to Oct. 4, 1924.

Charles Henry White has recently returned to San Francisco from Battle Mountain, Nev., and has established new headquarters at Room 340, Mills Building, San Francisco.

Dr. John Parke Young, who has been making studies of foreign currency and exchange for the Senate Commission of Gold and Silver Inquiry, will return to the United States early in August.

Robert Wesley Brown

Robert Wesley Brown, petroleum engineer and geologist, of Shreveport, La., is doing valuation work on oil and gas lands for various oil companies and for the U. S. Bureau of Internal Revenue.

R. S. Knappen, assistant professor of economic geology at the University of Kansas, was recently at Virginia City, Nev. Professor Knappen is visiting the principal mining districts in the state.

W. Earl Greenough, of Wallace, Idaho, manager of the Atlas Mining Co., which recently started development in the Coeur d'Alene district, is in New York on business connected with his company.

Eggleston Smith has opened an office in the Grand Central Terminal, New York City, in connection with his inventions in well-drilling apparatus, with special reference to the recovery of rock cores.

Dr. Charles Camsell, Canadian Deputy Minister of Mines, has been visiting the seven field parties of the Canadian Geological Survey which are working this season in different counties of Nova Scotia.

N. H. Darton, geologist, is en route to Mexico on leave of absence for two months. He will endeavor to determine the age of the pre-Maya remains and temple near Mexico City for the National Geographic Society.

Ira A. Williams, who has been for the past ten years geologist of the Oregon Bureau of Mines and Geology, has opened an office at 821 Spalding Building, Portland, Oregon, and will engage in practice as a consulting geologist.

John Borg, of New York, president of the Callahan Zinc-Lead Co., after spending a month in the Coeur d'Alene district, in Idaho, has gone to Colorado Springs, where he will remain another month before returning to New York.

George W. Coffey, who has been employed as efficiency engineer for Miami Copper Co. during the last few years, has resigned. He sailed recently from New York for Bolivia, where he will be engaged in examination of placer deposits.

I. O. Proctor, mill superintendent for the Nabob Mining Co., operating in the Coeur d'Alene district in Idaho, is recovering from serious burns received while attempting to save the company's mill which was destroyed recently by forest fires.

Arthur Thacher has resigned as manager for the Annapolis Lead Co., operating in southeast Missouri, and has been succeeded by **J. Frank Thompson,** formerly superintendent for the National Lead Co. During Mr. Thacher's tenure the company largely increased its output and the monthly balance sheet was changed from red to black.

Louis Hirshler, of New York, has returned from a trip through Italy and Jugoslavia. He also visited Macedonia and Serbia, and reports that these countries are rich in mineral deposits, but their development is hampered by a lack of foreign capital. Mr. Hirshler negotiated sales of large amounts of bauxite and chrome while on his trip.

Admiral Sir Edmond Slade, vice-chairman of the board of directors of the Persian Oil Co., Ltd., recently gave a lecture in Melbourne, Victoria, on the "Oilfields of Persia." As very little had been known in Australia of the operations of this company in the vast territory over which it holds concessions, special interest attached to the occasion.

E. M. di Villa, an oil geologist now visiting Australia, whose opinion of the oil prospects of Western Australia and South Australia has already been published in *Mining Journal-Press,* has since stated in Melbourne that the Jurassic and Tertiary strata seen by him in Victoria are not encouraging for the occurence of oil. Mr. di Villa has had experience for a number of years in Eastern Asia and the Dutch East Indies.

Obituary

John H. Dunlap, secretary of the American Society of Civil Engineers, died on July 29 as a result of the injuries he received in a railroad wreck a month ago, when he was returning with other engineers from the meeting of the Society for the Promotion of Engineering Education at Boulder, Colo. President F. W. McNair of the Michigan School of Mines and Prof. Ives of the Ohio State University, it will be remembered, were also killed in this wreck.

William Motherwell, metallurgical engineer, well known in Australia, New Zealand, Africa, India, and America, died recently in Cranbrook, B. C.

Recent Technical Publications

Reviews, Abstracts, and References

Capital and Labor

Manpower in Industry. By Edward S. Cowdrick. Henry Holt & Co., New York. Price $3.

This interesting book treats of the rôle of the workingman in industry and does so simply, justly, and sympathetically. In view of present restrictive immigration laws and the marked change from the days when a large influx of cheap labor took place yearly, the relation of capital to labor has become greatly modified. The author shows how the treatment accorded the laborer has improved all the way down the line, from his initial employment to promotion or discharge. His description of the ideal waiting room in a corporation employment office as being a cheery and comfortable place, with reading matter and other conveniences, will doubtless carry the reader's thoughts back to the early methods in many mining camps, and the "hard-boiled" manner of selecting and discharging men—a practice still open to improvement in some mining districts. I do not mean to imply that the author presents only labor's side of the story. He is careful to explode many misconceptions common among laboring classes about certain economic truisms. This is what he has to say about the effect of machines upon employment of labor: "With the aid of machines the available laborers produce far more than they could have done by their own efforts. This means that there is a greater supply of 'real' wealth to be divided among the members of the community, including workers and employers. The resulting high wages increase the purchasing power of the laboring class and bring a demand for yet more goods. This demand, in turn, stimulates the invention and adoption of yet more machinery and more expert management."

An important matter discussed in the book is the welfare work that can be done by corporations without their becoming paternalistic and losing the respect of the workmen. Hardly a phase of welfare work is left untouched, and the functions of housing, insurance, stock participation, and such subjects as industrial relations, personnel organization, and the part of the public in labor disputes are elaborated in the text. Thoroughout the book the author has tried, and admirably succeeded, in being fair to both capital and labor. A reading of the work will aid anyone in clear thinking upon labor problems, whether employer or employee. It is really a text on one of the most vital phases of economics—labor and wages.

F. E. WORMSER.

Roofing Slate—Bulletin No. 82, 4 pages, obtainable on request from the Topographic and Geologic Survey, Harrisburg, Pa., is by R. W. Stone, and is entitled "Roofing Granules Industry in Southeastern Pennsylvania." The paper discusses the grinding and preparation of slate, most of it colored, for roofing manufacture.

Mining in Northern Ontario—"The Mining Industry in That Part of Northern Ontario Served by the T. & N. O. Ry." for 1922 and 1923, 40 pages, obtainable on request fron the T. & N. O. Ry. Commission, Parliament Buildings, Toronto, Ont., describes the recent work that has been done at the various active properties in Cobalt, Kirkland Lake. Porcupine, and associated districts.

Idaho Geology—Bulletin No. 6 of the Idaho Bureau of Mines, Moscow, Idaho, 78 pages, obtainable on request, discusses the "Geology and Water Resources of the Goose Creek Basin, Cassia County, Idaho." It is by Arthur M. Piper.

Corrosion-resisting Alloys—Dr. B. D. Saklatwalla, of the Vanadium Corporation of America, Bridgeville, Pa., has written a paper on "Ferrous Alloys Resistant to Corrosion," which was read before the American Section of the Society of Chemical Industry in New York recently. The paper, of 5 pages, was reprinted in the *Iron Age* of April 24, 1924, and separate reprints can also be had upon application to the author. The so-called stainless steels can now be produced without the use of expensive ferrochromium, chrome ore and ferrosilicon being used instead.

Extralateral Rights—The American Institute of Mining and Metallurgical Engineers, 29 West 39th St., New York City, has recently issued a 29-page paper by Orrin P. Peterson entitled "Some Geological Features and Court Decisions of the Utah Apex-Utah Consolidated Controversy, Bingham District," which will be of interest to those having similar difficulties.

Canadian Mineral Industry — The Canadian Pacific Ry., Montreal, has recently issued for free distribution a series of bulletins of two to four pages each containing synopses of information regarding the mineral industry of the dominion. Occurrences, uses, and marketing information are given. The bulletins cover the following subjects: Abrasives; Arsenic; Asbestos; Barytes; Bituminous Sand; Chromite, Clay, Shale, and Limestone; Fire and Ball Clay; Coal; Cobalt; Copper; Diatomaceous Earth; Feldspar; Fluorspar; Gold; Granite; Graphite; Gypsum; Iron; Kaolin; Lead and Zinc; Limestone; Manganese; Magnesite; Mica; Mineral Water; Molybdenum; Natural Gas; Nickel; Ocher; Peat; Petroleum; Phosphate; Platinum; Potash; Pyrites; Salt; Sand and Gravel; Silica; Silver; Slate; Sulphates of Sodium and Magnesium; Talc and Steatite; and Water Power.

The Department of Mines of Ontario, Toronto, also issued a handbook of its mines and mineral resources for distribution at the British Empire Exhibition, which will be sent free to interested readers. It describes briefly but in an interesting way the various ramifications of industries which turned out products to the value of about $70,000,000 last year, and includes maps of the mining districts.

Silver in Chloride Volatilization—The U. S. Bureau of Mines, Washington, D. C., has recently published Technical Paper 317, "Silver in Chloride Volatilization," 56 pages, by C. M. Bouton, W. C. Riddell, and L. H. Duschak. In the early work with chloride volatilization at the Salt Lake station, salt was mixed with oxidized ores and the mixture treated in a suitable furnace, such as a rotating cement kiln, the fume being precipitated by the Cottrell process. Good extractions were obtained of lead and gold, and fair extractions of copper, but only occasional success with silver ores. The work reported in this paper was undertaken to ascertain what conditions were necessary for chloridizing silver ores. A summary of the main points brought out in the study of the possible causes for the low extraction of silver during chloride volatilization indicates that:

1. The vapor pressure of silver chloride is high enough to allow the silver to be extracted if it is converted to the chloride.

2. Most silver compounds are easily converted into metallic silver when roasted in air. If this metallic silver is formed above its melting point, 961 deg. C., it is likely to occur as small globules that present a minimum surface to the chloridizing atmosphere and hence lengthen the time required in the furnace for successful chloridization.

3. The presence of water vapor in the furnace gases tends to produce metallic silver from silver chloride if not enough hydrochloric acid or chlorine is present in the furnace gases. Experimental work has shown that quite low concentrations of hydrochloric acid or chlorine gas are needed for the amounts of water vapor usually present in the furnace gases. This source of trouble is therefore probably less important than the previous one, except in the event of depletion of chloridizing reagent before all silver is expelled.

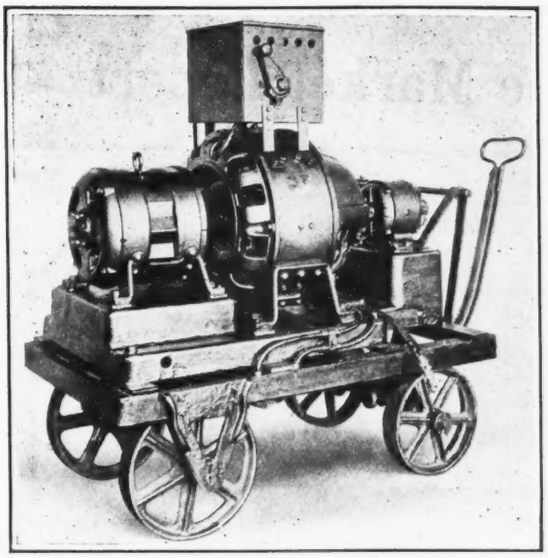
4. Very little evidence exists that would indicate the possibility of the formation of a silver silicate, but silver can seemingly enter silica in small amounts, possibly in colloidal form. This may account for a part of the "tightly held" silver in roasted ores.

One byproduct of these investigations was an insight into the causes of losses in assaying, particularly in cupelling silver buttons. The conclusions reached are described in a separate note.

The bulletin is available free from the U. S. Bureau of Mines, as is also Bulletin No. 211 on the chloride volatilization process issued last year.

Lime From Small Stone—"Profitable disposal of limestone too small for making lime in the shaft kiln is one of the most urgent problems in the lime industry," says W. M. Myers, in "The Production of Lime From Small Stone." This is No. 2,596 of the U. S. Bureau of Mines Reports of Investigations, 9 pages, obtainable on request. The use of the rotary kiln for the small stone is advised, and Mr. Myers thinks that form of kiln will have increasing use, even for large sizes.

This 200-amp. arc welding apparatus is available in either stationary or portable form. It is ruggedly built to withstand rough usage.



New Machinery and Inventions

Arc-Welding Equipment for Rough Usage

A compact, entirely self-contained, single-operated 200-amp. arc-welding apparatus which is available in either the stationary or portable form has recently been designed by the Westinghouse Electric & Manufacturing Co. The generator will deliver 300 amp. on intermittent work. Any welding current from 60 to 300 amp. may be obtained by operating the rheostat handle, which is conveniently located outside the control cabinet, which is mounted on top of the generator. The sixty-one rheostat resistance steps enable the operator to obtain close current control if desired.

If an extremely high current is desired, the generators of several machines may be operated in parallel. The generator is designed to stabilize the arc, inherently thereby overcoming instantaneously any resistance fluctuations in the arc circuit, and, at the same time, eliminating the necessity for relays, solenoid controlled resistors, or other like instruments. Because of the special design of the generator, the operator can readily strike and maintain the arc, obtaining the necessary penetration and fusion for good welding. Any of the commercial sizes of metallic electrodes from $\frac{1}{16}$ in. to $\frac{1}{4}$ in. in diameter may be used.

The generator and driving motor are mounted on a common shaft to which the exciter is coupled by means of a special flexible coupling. Ball bearings are used throughout to eliminate the leakage of oil when operated on inclined positions.

The driving motor is of standard Westinghouse construction and may be either a d.c. Type SK motor or an a.c. Type CS squirrel-cage motor, depending upon the character of the supply service. Alternating current driving motors may be used on 220 and 440-volt supply circuits by simply rearranging the lead connections.

Alternating-current motors are started by connecting them directly to the line through a safety switch. Direct-current motors are started by means of a Type D starting rheostat. In both cases, all the operating mechanism except the handle is within the control cabinet, eliminating the danger of contact with live parts.

An ammeter and voltmeter, if desired, are mounted on the cabinet where they are readily observed by the operator as he adjusts the rheostat for current control.

The rugged construction of the unit makes it particularly adapted to places where welding equipment receives rough usage.

Another Mill for Fine Grinding Introduced

Several distinct advantages over other types of ball and rod mills are claimed for the pulverizer illustrated in the accompanying cuts. It is known as the Giant pulverizing mill. These advantages are:

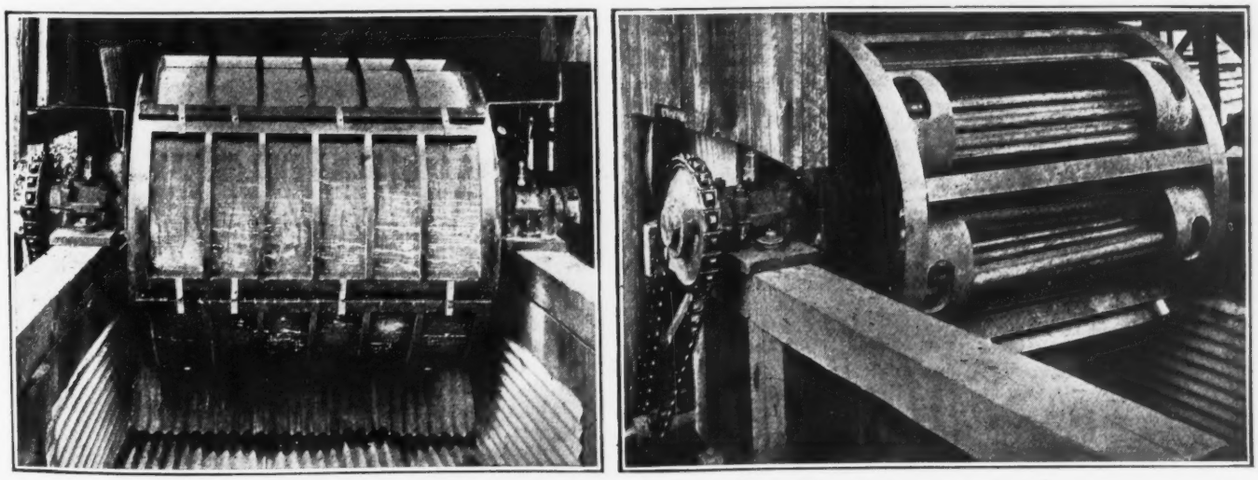
First, the grinding element has its weight distributed around the circumference of the mill, thereby reducing the power required for operating to about 20 per cent of that required by other types of ball and rod mills. Second, the material being ground drops out through the screens as soon as it reaches the proper mesh. On account of this factor, it is not held in the mill and ground after it has reached the desired fineness.

In other types of ball and tube mills it is stated it is necessary to screen the ground material discharged from the mill, thereby requiring a second operation whereby the tailings from the screens are elevated and returned to the feed end of the mill.

In the Giant mill, however, the raw material is fed continously into both ends of the mill and the ground material is discharged through the screens when it reaches the proper mesh, and no separate screening is required.

In operation, the mill is inclosed in a dust-tight cover which ends at the bottom in the form of a hopper from which the ground finished product is conveyed to storage.

The Tamaqua Manufacturing Works, Tamaqua, Pa., has obtained the rights to make and sell this mill in the East. Carl S. Willis, of Bellingham, Wash., is the patentee.



Left—Pulverizing mill with screens attached. Right—Mill with screens removed

The Market Report

Daily Prices of Metals

July	Copper, N. Y. net refinery*	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
31	12.875	49.00	49 50	7.55	7.45	5.95@6.00
Aug. 1	12.75@12.875	49 125	49.625	7.50	7.325@740	5.95
2	12.875	49 375	49.875	7.50	7.35	5.95
4	13.00	49.75	50.25	7.50	7.35	6.00@6.05
5	13.00@13.125	51.125	51.625	7.50	7.35	6 10@6.15
6	13.125	51.50	52.00	7.50	7.35	6.15@6.175
Av.	12.958	49.979	50.479	7.508	7.369	6.031

*These prices correspond to the following quotations for copper delivered: July 31st, 13.125c.; Aug. 1, 13.00@13.125c.; Aug. 2, 13.125c.; Aug. 4, 13.25c.; Aug. 5, 13.25@13.375; Aug. 6, 13.375c.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

The quotations are arrived at by a committee consisting of the market editors of *Engineering and Mining Journal-Press* and a special representative of the Bureau of Mines and the Bureau of Foreign and Domestic Commerce.

London

July	Copper			Tin		Lead		Zinc	
	Standard		Electro-lytic						
	Spot	3M		Spot	3M	Spot	3M	Spot	3M
31	62 7/8	63 7/8	67 1/4	247 3/4	248	33 1/2	31 7/8	32 1/4	32 1/4
Aug. 1	63	63 7/8	67	248 1/2	248 5/8	32 1/2	31 3/8	32 1/8	32
4	...	...	...	....	....	...	...	...	...
5	64 1/4	65 1/8	67 3/4	256 3/4	256 3/4	32 3/4	31 7/8	32 1/2	32 1/2
6	64 1/4	65 1/8	68	259 1/4	259 1/2	32 3/4	31 7/8	32 1/2	32 1/2

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver, Gold, and Sterling Exchange

July	Sterling Exchange "Checks"	Silver		Gold London	Aug.	Sterling Exchange "Checks"	Silver		Gold London
		New York	London				New York	London	
31	4.39 5/8	67 3/4	34 1/2	93s 9d	4	4.44 1/2	68 1/2	....	... ..
Aug. 1	4.40 1/2	68 1/4	34 5/8	93s 10d	5	4.46	68 5/8	34 9/16	92s 8d
2	4.43	68 3/4	34 3/4	.....	6	4.45 1/4	68 3/8	34 7/16	92s 3d

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London silver quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command one-quarter of a cent premium.

Metal Markets Continue to Improve

New York, Aug. 6, 1924—In a nutshell, copper, zinc, and tin are up in price, while lead is a trifle easier. Silver also continues its upward movement, reaching a high of 68¾c. per oz., and then declining slightly. Sales of all the metals have been good. In copper and zinc the demand from Europe, added to the domestic demand, has helped to improve prices. Much of the foreign business is speculative.

Copper Advances to 13⅜c.

The sudden advance in the London standard copper market on Monday had an immediate effect upon the New York market; prices stiffened at once. Whereas copper had been sold earlier in the week at 13c. to 13⅛c., delivered, producers were able to obtain 13¼c., some of them asking 13⅜c. but failing to book any sales until the following day. At present, copper is readily obtainable at 13⅜c., with a few producers asking 13½c. No sales have been recorded at this level, however. Consumers are interested not only in prompt shipment copper but also in transactions involving delivery far ahead into next year. Export business has been satisfactory, with Germany an important factor. Stocks of copper are growing abroad.

Average Metal Prices for July

Copper:	
New York Electrolytic	12.390
London Standard	61.652
London Electrolytic	65.815
Lead:	
New York	7.117
St. Louis	6.886
London	32.916
Silver:	
New York	67.159
London	34.509
Sterling Exchange	436.649
Zinc:	
St. Louis	5.898
London	32.193
Tin:	
99 per cent	45.75
Straits	46.25
London	233,332
Quicksilver	72.173
Antimony	8.477
Platinum:	
Refined	118.231
Crude	113.865

Activity in Lead Subsides a Little

The official contract price of the American Smelting & Refining Co. continues at 7.50c. per lb. New York.

Premiums over the contract price in New York are difficult to obtain from consumers. By far the greatest number of sales made, on a tonnage basis, were concluded at 7.50c. per lb., New York. Sales in the West were light in volume and varied between 7.35 and 7.40c. per lb., St. Louis. Today the actual metal can be procured in several directions for 7.35c. per lb. The lead market may be said to have reached a balance.

Sharp Rise in Zinc Occurs

The price of zinc registered a pronounced increase during the week, carrying it from 5.95c. to 6.175c., East St. Louis, on the movement. Sales were good nearly every day, with a strong interest in the market shown by both domestic and foreign consumers. A fair tonnage of Brass Special was sold on Tuesday. Galvanizers were also important participants in the market.

High-grade zinc continues to bring from 8 to 8¼c. per lb., delivered. The New York market is 35 points above that of East St. Louis.

Correction—The price of East St. Louis zinc on July 24 should have been 6.05 to 6.075c., instead of 5.05 to 5.075c.

Price of Tin Boosted Further

Tin continues its regular advance, with but a moderate amount of interest shown by domestic consumers. Straits is now up to 52c. per lb. Speculative sales and purchases remain an important stimulus to the market.

Arrivals of tin in July, 4,792 tons at Atlantic ports and 130 at Pacific ports. Arrivals in August to Aug. 5 were 875 tons.

New 1924 High for Silver

The New York market touched a new high level for the year on Aug. 2, the quotation of 68¾c. being ¼c. higher than the top for the year 1923. A slight reaction has occurred since, but the market appears steady although quiet.

Mexican Dollars—July 31, 52¼c., Aug. 1, 52¼c.; 2d, 52⅜c.; 4th, 52⅜c.; 5th, 52⅞c.; 6th, 52⅝c.

Foreign Exchange Up

Exchanges have moved upward on the strength of a probable settlement of the reparations question. On Tuesday, Aug. 5, francs were 5.49c., lire 4.41c., and Canadian exchange in New York was $\frac{3}{16}$ per cent discount.

Other Metals

Quotations cover large wholesale lots, f.o.b. New York, unless otherwise specified.

Aluminum—99 per cent, 28c. per lb.; 98 per cent, 27@28c.

London, 98 per cent, £125 per long ton.

Antimony—Per lb.:
Chinese and Japanese brands, 8¼@9c.
W. C. C. brand, 10¾@11¼c.
Cookson's "C" grade, 11⅝@11⅝c.
Chinese needle, lump, nominal, 8½@9c.
Standard powdered needle, 200 mesh, 9@10c.
White oxide, Chinese, 99 per cent Sb_2O_3, 10@11c.

Bismuth—$2.40@$2.45 per lb. London, 10s.

Cadmium—60c. per lb. London, 2s. 6d.

Cobalt—$2.50@$3 per lb. Discounts on contracts. Oxide, $2.10@$2.25. London, 10s. for metal; 9s. for black oxide.

Germanium Oxide—25 to 50 gm. lots, $10 per gm.

Iridium—$260@$270 per oz. Nominal.
Iridium alloyed with platinum, $280@$286.

Magnesium—Sticks, 1⅛ in., 99.9 per cent, 90c.@$1 per lb. London quotes 3s. 3d. for 99 per cent.

[1]**Molybdenum**—99 per cent, $12 per lb.

Monel Metal—32c. per lb.

Nickel—27c. per lb. for 99 per cent virgin metal. London, £135.

Osmiridium—Crude, $58.50 per oz.

Osmium—$95@$104 per troy oz.

Palladium—$78@$83 per oz. Crude, $60 per oz. London, £17.

Platinum—Refined, $120 per oz.
Crude, $113@$114.
London, £27 for manufactured.

Quicksilver—$72.50 per 75-lb. flask. San Francisco wires $72.35. London, £13.

Radium—$70 per mg. radium content.

Rhodium—$85@$90 per oz.

Ruthenium—$40@$45 per oz.

Selenium—Black powdered, amorphous, 99.5 per cent pure, $2.10 per lb.

Tantalum—Metal, $400 per kg.

Tellurium—$2 per lb.

[1]**Thallium Metal**—Ingot, 99 per cent pure, $8 per lb.

Tungsten Metal—Powder, 97 to 98 per cent, 95c.@$1 per lb. contained tungsten.

[1]**Zirconium Metal**—98 per cent grade, per lb., $30.

Metallic Ores

Chrome Ore—Per ton, c.i.f. Atlantic ports:
Indian, $18.50@$19.50.
Rhodesian, $21.50.
New Caledonian, $24.
Market nominal.

[1]**Galena Radio Crystals**—Best quality (50 per cent of sized fragments good) 50c. per lb. in 500 lb. lots, f.o.b. Philadelphia.

Iron Ore—Lake Superior ores, per long ton, Lower Lake ports:
Old Range, bessemer, 55 per cent iron, $5.65.
Mesabi, bessemer, 55 per cent iron, $5.40.
Old Range, non-bessemer, 51½ per cent iron, $4.90.
Mesabi, non-bessemer, 51½ per cent iron, $4.75.

Magnetite Ore—F.o.b. Port Henry, N. Y., per long ton:
Old bed, 21 furnace, $5.
Old bed, concentrates, 63 per cent, $5.25.
Harmony, cobbed, 63 per cent, $5.25.
New bed, low-phosphorus, 65 per cent, $7.50.

Manganese Ore—42@45c. per long ton unit, seaport, plus duty. Nominal. Chemical grades[1], powdered, coarse or fine, 82@87 per cent MnO_2, Brazilian, Caucasian, and Javanese, $75@$80 per ton in carloads.

Molybdenum Ore—80c. per lb. of MoS_2 for 85 per cent MoS_2 concentrates. Nominal.

Pyrite Radio Crystals—(Best quality) $1.50 per lb. in 500-lb. lots.

Tantalum Ore—Foreign, 30@50c. per lb. of Ta_2O_5 contained, c.i.f. New York, according to quality.

Tungsten Ore—Per unit, N. Y.:
High-grade wolframite, $9@$9.25.
High-grade scheelite, $9.25.
Ordinary grades, $8.25@$8.50.
Market nominal.

Vanadium—Minimum 18 per cent V_2O_5, $1@$1.25 per lb. Nominal.

Zinc and Lead Ore Prices Unchanged

Joplin, Mo., Aug. 2, 1924—Zinc blende, per ton, high, $42.60; basis 60 per cent zinc, premium, $42; Prime Western, $41@40; fines and slimes, $39@$36.50; average settling price, all grades of blende, $40.63.

Lead high, $88.50; basis 80 per cent lead, $90; average settling price, all lead ore, $85.12 per ton.

Shipments for the week: Blende, 15,172; lead, 1,299 tons. Value, all ores the week, $727,040.

Lead settlements were adjusted on the price offerings of last week, the offerings this week being for future deliveries. A slight increase in lead movement is shown. Zinc prices were not materially changed, except on fines and slimes, though the demand weakened, dropping from 19,500 tons last week to 10,240 tons this week.

Platteville, Wis., Aug. 2, 1924—Blende, basis 60 per cent zinc, $43.50 per ton. Lead, basis 80 per cent lead, $92.50 per ton. Shipments for the week: Blende, 821 tons; lead, 38 tons. Shipments for the year: Blende, 17,935; lead, 690 tons. Shipments for the week to separating plant, 1,820 tons blende.

[1]Price furnished by Foote Mineral Co., Philadelphia.

Non-Metallic Minerals

Prices received for non-metallic minerals vary widely and depend upon the physical and chemical characteristics of the commodity. Hence the following quotations can only serve as a general guide as to the prices obtained by producers and dealers in different parts of the United States for their own product. In the last analysis the value of a particular non-metallic mineral can only be ascertained by direct negotiation between buyer and seller.

[1]**Amblygonite**—8@9 per cent lithium oxide, $50@$60 per ton, f.o.b. mines.

Asbestos:
Crude No. 1—$300@$400.
Crude No. 2—$150@$225.
Spinning fibers—$90@$150.
Magnesia and compressed sheet fibers—$70@$100.
Shingle stock—$50@$70.
Paper stock—$35@$40.
Cement stock—$17.50@$20.
Floats—$8@$12.
All per short ton, f.o.b. mines, Quebec, tax and bags included.
No. 1 Rhodesian crude, $325; No. 2, $200 per short ton, c.i.f. New York.
Market quiet and prices unsatisfactory to producers.

Barytes—Crude—$8 per ton, Missouri mines, 90@98 per cent $BaSO_4$; $9 per ton, f.o.b. Georgia mines; $6@$8, at Baltimore.
Ground—Off color, $13 per ton, Baltimore; white, $17, Baltimore.
Water ground and floated, bleached, $23@$24, f.o.b. St. Louis.
Shipments for July and August about 70 per cent of normal. Business good.

Bauxite—American, f.o.b. shipping point per gross ton:
Crushed and dried, $5.50@$8.75.
Pulverized and dried, $14.
Calcined, crushed, $19@$20.
Foreign, per metric ton c.i.f.:
French, 5 per cent SiO_2, $5@$7.
Dalmatian, low SiO_2, $5@$7.50.
Other grades, $6.

Beryl—4½c. per lb. f.o.b. Connecticut points. Nominal.
$85 per ton, hand-sorted crystals, f.o.b. New York. Nominal.

Borax—Granulated and refined, crystals or powdered, in bags, carloads, 4¾c. per lb.; in bbls., 5c. Boric acid, 10½c.

[1]**Celestite**—90 per cent $SrSO_4$, finely powdered, $40 per ton in carload lots.

Chalk—F.o.b. New York, per lb.:
English, extra light, 5c.
Domestic, light, 4¼@4½c.
Domestic, heavy, 3½@3¾c.
In bulk, $5@$5.50 per ton.

China Clay (Kaolin)—F.o.b. Virginia mines, per short ton:
Crude No. 1, $7.
Crude No. 2, $6.
Washed, $8.50.
Powdered, $13@$20.
Powdered (Blue Ridge), $14@$20.
Imported English, f.o.b. American ports:
Lump, $15@$20.
Powdered, $45@$50.
1A grade, domestic, $16@$18, f.o.b. mines. Good demand.

Diatomaceous Earth—Per short ton, f.o.b. plant, California, as on page 236:

Kiln-fired brick, $65.
Kiln-fired aggregate, ¼ in., $45.
Insulating powder, $30.
Natural aggregate, ¼ in., $20.
Air-floated powder, $40.

Emery—Per lb., f.o.b. plant:
Greek Naxos, 6½c.
Turkish, 6½c.
Khasia, 5½c.
American, 3½@4c.
Market quiet.

Feldspar—Per long ton, f.o.b. cars, *North Carolina:*
No. 1 pottery grade, $6.50@$7.25, depending upon quality.
No. 2 pottery grade, $4.50@$5, depending upon quality.
No. 1 soap grade, $6.75@$7.25.
Market good for extra quality but poor for ordinary grades.

In *Connecticut*, per net ton, f.o.b. mines:
60 to 80 mesh, $20.
150 mesh, $25.
200 mesh, $30.

In *New Hampshire*, per net ton, f.o.b. mines:
No. 1, not exceeding 10 per cent SiO_2, $8.
No. 2 pottery grade, $7.
Ground, $17@$20, f.o.b. mill.
Market better than for three months.

In *New York*, per ton, f.o.b. cars:
No. 1, $8. Demand good.

In *Maine:*
No. 1 ground, $19.

In *Tennessee:*
Pottery grades, $15.30@$21.
Tile grades, $14@$18.
Enameling grades, $11@$16.
Crude, $7 for ordinary grades. As high as $7.25 offered for exceptional quality.
Market slack. Overproduction at present taking place.

In *Canada:*
No. 1 crude, $7 per short ton.
No. 1 ground, 180 mesh, $20.

Fluorspar — F.o.b. Middle Western mines, per net ton:
Not less than 80 per cent CaF_2 and not over 5 per cent SiO_2, $22.
Not less than 85 per cent CaF_2 and not over 5 per cent SiO_2, $23.50.
Ground, 93 to 98.5 per cent CaF_2 and not over 3 per cent SiO_2, $35 in bulk, $39 in bags or barrels.
Acid, ground, not less than 98½ per cent CaF_2 and not over 1 per cent SiO_2, $45 in bulk, $49 in packages.
Market very quiet because of steel situation. Not much spar moving.

Fuller's Earth—Per ton, f.o.b. Midway, Fla.:
16 to 30 mesh, $16.50.
16 to 60 mesh, $18.
30 to 60 mesh, $18.
60 to 100 mesh, $14.
Plus 100 mesh, $7.50.
Powdered, imported, duty paid, $23 @$25 per ton.

Garnet—Per short ton:
Spanish grades, $60, c.i.f. port of entry.
Domestic Adirondack, $85, f.o.b. shipping point.
Canadian, $70@$80, f.o.b. mines.

Gilsonite—Per ton, f.o.b. Colo.:
Jet asphaltum, $36.
Selects, $33.
Seconds (ordinary grades), $25.50.

Graphite—First quality, per lb.:
Ceylon lump, 5½@6c.
Ceylon chip, 4½@5c.
Ceylon dust, 2@3½c.
Crude amorphous, $15@$35 per ton.
Powdered amorphous, 4@8c. per lb.
Flake, finely ground, 25@75c.
Lubricating quality, 8@30c.
Foundry quality, 3@6c.
Market unsatisfactory. Small amounts coming from Ceylon and Madagascar.

Gypsum—Per ton, depending upon source:
Crushed rock, $3@$4.50.
Ground, $3.50@$6.
Agricultural, $5@$7.
Calcined, $8@$16.

Ilmenite—Concentrates, 52 per cent TiO_2, 1½c. per lb., f.o.b. Virginia points. $25 per short ton, Florida mines.

Iron Oxide—(see ocher) Ground 95 per cent through 200 mesh Standard Spanish red, $45 per ton.

Kaolin—See China Clay.

Lepidolite—$20@$30 per ton for ordinary grades.

Limestone—Depending upon source, f.o.b. shipping points; per ton:
Crushed, ½ in. and less, $1.10@$1.70.
Crushed, 3 in. and larger, 90c.@$1.50.
Agricultural, $1.50@$5.

Magnesite—Per ton, f.o.b. California mines:
Calcined lump, 85 per cent MgO, $35.
Calcined ground, 200 mesh, $45.
Dead burned, $32@$34, Washington.
Dead burned, $40@$42, Chester, Pa.
Caustic calcined, Grecian, $50@$51, c.i.f., New York.
Market quiet on account of easier conditions in construction and steel trades.

Manjak—Barbados, in 1 to 5 ton lots:
Grade "A," 6c. per lb.
Grade "AC," 7c. per lb.
Grade "AA," fine, 8c. per lb.
Grade "C," fine and lump, 9c.
Grade "C," lump, 12c.
Market inactive.

Mica—
North Carolina prices:
Scrap, $17@$20 per ton.
Sheet, per lb., No. 1 quality, clear:
Punch, 1½ in., 7c.

1½ x 2 in., 16c.	3 x 4 in., $1.75.
2 x 2 in., 30c.	3 x 5 in., $2.35.
2 x 3 in., 75c.	4 x 6 in., $3.
3 x 3 in., $1.25.	6 x 8 in., $4.50.

Ground, 60 mesh, $65 per ton.
Ground, 80 mesh, $70.
Ground, 120 mesh, $120.
Ground, 140 mesh, $125.
Dry ground, roofing, $27.50.
Dry ground, 80 mesh, $32.50.
Dry ground, 100 mesh, $55.00.
Dry ground, 160 mesh, $70.00.

In *New Hampshire:*
Washer and disk, $280 per ton.
Scrap, $24 per ton.

[1]**Monazite**—Minimum 6 per cent ThO_2, 6@8c. per lb.

Ocher—"Yellow Peruvian," $25@$30 per ton, Georgia mines.

Ozocerite—Per lb. in bags, New York:
Black, 160 deg. melting point, 26@27c.
Green, 170 deg. melting point, 28 @29c.

[1]Price furnished by Foote Mineral Co., Philadelphia.

Phosphate — Per long ton, f.o.b., *Florida* export prices:
76@77 per cent, pebble, $5.75.
75 per cent, $5.50.
74@75 per cent, $5.25.
70 per cent, $3.50.
68 per cent, $3.

In *Tennessee*, per long ton:
75 per cent hand mined lump, $6.50.
75 per cent washed lump, $6.75.
72 per cent washed run of mine, $5.50.
65 per cent ground 95 per cent through 100 mesh, $7.00 per short ton.
Ground rock shipping season on. Not much activity in lump, as it is now repair season for furnaces.

Potash—Contract prices, per ton:
Kainit, 14@16 per cent, $7.33.

Pumice Stone—Imported lump, 3@40c. per lb.
Powdered, in bbl., 3@5c.
Lumps, in bbl., 6@8c.

Pyrites—Tharsis, per long ton unit, c.i.f. U. S. ports:
Furnace size, 12c.
Lump, 11c.
Fines, through ¼ in., 11½c.
Cinder from ore to remain property of buyers.
Market quiet.

Quartz Rock Crystals — Colorless, clear and flawed, pieces, ¼ to ½ lb. in weight, 40c. per lb. in ton lots.
For optical purposes, double above prices.

Rutile—F.o.b. Virginia points, per lb.:
Granular, 94@96 per cent TiO_2, 12@15c.
Pulverized, 100 mesh, 94@96 per cent, 17@30c.
93 per cent TiO_2, 12c., Florida, delivered.

Silica—Water ground and floated, per ton, f.o.b. Illinois:
450 mesh, $31@$34.
350 mesh, $25@$28.
250 mesh, $23.
200 mesh, $20.
100 mesh, $8.
Glass sand, $2@$2.25 per ton; brick and molding sand, $2@$2.25.

Spodumeme—$20@$30 per ton, depending upon lithium content.

Sulphur—$16@$18 per ton for domestic, f.o.b. Texas and Louisiana mines; $18@$20 for export, f.a.s. New York.

Talc—Per ton, in 50 lb. paper bags, *Vermont* mills, carloads:
Ground, 200 mesh, extra white, $10.50.
Ground, 180 mesh, medium white, $10.
Ground, 160 mesh, medium white, $9.50.
Prices firm, but demand is lighter than recently.

In *New York*, double air-floated, including containers:
200 mesh, $13.75.
325 mesh, $14.75.
100 mesh, $11, not air-floated.
Demand good.

In *California*, $20@$30 per ton, ground.

In *Georgia*, powdered, per ton:
White, $12@$15.
Grayish white, $8@$10.

Red, $12@$14.
Yellow, $8@$12.
Roofing, $7.50@$8.

Tripoli—Per short ton, burlap bags, paper liners, per minimum carload 30 tons, f.o.b. Missouri:
Once ground:
Rose and cream colored, $16@$25.
White, $18@$27.
Double ground:
Rose and cream, $17@$25.
White, $19@$30.
Air-float:
Rose and cream, $25@$30.
White, $35.
Market steady.

Zircon—Freight allowed east of Mississippi River:
99 per cent, 6c. per lb., f.o.b. Florida.
Powdered, 7c. per lb., f.o.b. Florida.

Mineral Products

Arsenious Oxide (white arsenic)—7⅞c. per lb. Sales of imported material made at concessions.

Copper Sulphate—4.60@4.70c. per lb.

Potassium Sulphate—Basis 90 per cent, $45.85 per ton.

Sodium Nitrate—$2.35@$2.65 per 100 lb., ex vessel Atlantic ports.

Sodium Sulphate—$16@$18 per ton, New York.

Zinc Oxide—Per lb. in bags:
Lead free, 7⅞c.
5 per cent lead sulphate, 6¾c.
10 to 35 per cent lead sulphate, 6⅝c.
French, red seal, 9⅝c.
French, green seal, 10⅝c.
French, white seal, 11⅞c.

Ferro-Alloys

[1]**Ferrocerium**—$7 per lb.

Ferrochrome—1 to 2 per cent carbon, 30c. per lb.; 4 to 6 per cent carbon, 12¼c. per lb.

Ferromanganese — Domestic, 78@82 per cent, $100 per gross ton, f.o.b. furnace. Spiegeleisen, 19@21 per cent, $33, f.o.b. furnace; 16@19 per cent, $32.

Ferromolybdenum—$2 per lb. of contained molybdenum for 50 to 55 per cent grades.

Ferrosilicon—10 to 12 per cent, $39.50 @$43.50 per gross ton, f.o.b. works; 50 per cent, $72@$75 delivered.

Ferrotitanium—For 15 to 18 per cent material, $200 per ton, f.o.b. Niagara Falls, N. Y.

Ferrotungsten — 90@93c. per lb. of contained W, f.o.b. works. Quiet.

[1]**Ferro-uranium**—35 to 40 per cent U, $4.50 per lb. of U contained, f.o.b. works.

Ferrovanadium—$3.25@$3.75 per lb. of V contained, f.o.b. works.

Metal Products

Rolled Copper—Sheets, 20¼c.; wire, 15c.

Lead Sheets—Full lead sheets, 10¾c. per lb.; cut lead sheets, 11c. in quantity, mill lots.

Nickel Silver—26¼c. per lb. for 18 per cent nickel Grade A sheets.

Yellow Metal — Dimension sheets, 17⅜c. per lb.; rods, 14⅜c. per lb.

Zinc Sheets—9½c. per lb., f.o.b. works.

[1]Price furnished by Foote Mineral Co., Philadelphia

Refractories

Bauxite Brick—$140@$145 per M., Pittsburgh, Pa.

Chrome Brick—$50 per net ton, f.o.b. shipping point.

Firebrick—First quality, $42@$45 per M., Ohio and Kentucky works; $42@$45 Central Pennsylvania; second quality, $35@$38.

Magnesite Brick — 9-in. straights, $65 per net ton, f.o.b. works.

Magnesite Cement—$47@$50 per net ton, f.o.b. Chester, Pa.

Silica Brick—$38 per M. Pennsylvania; $48@$50 Alabama.

Zirkite—Powdered, 80 per cent ZrO_2, 5c. per lb.; 70 per cent, 2½c. per lb. Brick, straights, 75@95c. each.

Iron Trade Improving

Pittsburgh, Aug. 5, 1924—The volume of steel buying and steel production has lately swung around the turn, several weeks ago as to buying, and at about the middle of July as to production. General line buying has been improving just enough for the increase to be perceptible. Plates in fair-sized lots are now 2.00c., Pittsburgh, against 2.15c. a month ago, bars remaining at 2.15c.

Pig Iron—Market quiet but prices firmer. Bessemer, $20; basic, $19; foundry, $19; f.o.b. Valley furnaces.

Connellsville Coke — Market dull. Furnace unchanged at $3, foundry having gradually sagged 25c. to a range of $4@$4.50; heating coke, $2.60@$2.75; good grade medium-sulphur coke, $2.75@$2.85.

Imports and Exports of Metals and Ores, May, 1924 and 1923

Imports of Ores and Metals

	June, 1923	June, 1924
Antimony		
Ore	305,903	207,752
Liquated, regulus or metal	1,168,775	1,729,504
Copper		
Ore	4,341,019	10,664,657
Concentrates	2,912,880	3,131,390
Regulus, coarse metal, and cement copper	39,400	200
Total	7,293,299	13,796,247
Imported from		
Spain	510,820	1,016,234
Canada	197,894	4,043,342
Mexico	1,934,156	1,798,738
Cuba	1,134,880	.....
Chile	2,745,270	6,874,522
Colombia	.....	5,225
Peru	356,228	57,351
Other countries	414,051	835
Unrefined black, blister, converter copper in pigs, and other forms	46,540,898	52,698,756
Imported from		
Spain	371,987	.....
United Kingdom	.....	2,887
Canada	5,129,001	5,620,891
Mexico	10,015,435	7,802,748
Chile	18,684,401	13,616,153
Peru	7,021,813	8,973,871
Portuguese Africa	3,784,379	16,680,456
Other countries	1,533,882	1,750
Refined copper	10,348,894	14,475,248
Old and clippings for remanufacture	493,198	101,812
Composition metal, copper chief value	66,000	.....
Copper manufactures	13,626	18,691
Brass		
Old and clippings for remanufacture	2,884,200	279,382
Manufactures of brass	60,097	57,718
Lead		
Ore and matte	4,878,089	10,602,526
Bullion or base bullion	14,347,988	15,593,103
Pigs bars, other forms and old	4,028,725	2,849
Manufactures of, except type metal	32,595	24,833
Manganese ore, long tons	36,138	527,350
Pyrites, long tons	18,644	25,351
Tin		
Tin ore, tons	11	5
Tin in blocks, bars, and pigs	10,289,741	9,166,754
Imported from		
United Kingdom	987,709	2,521,436
British Straits Settlements	7,475,820	5,266,860
Dutch East Indies	913,994	247,163
Hongkong	876,378	866,846
Australia	35,840	40,320
Other countries	.....	224,129
Zinc ore (dutiable)	8,472	.....
Zinc in blocks, pigs and other forms (dutiable)	382	150
Zinc dust (dutiable)	5,227	30,545

Exports of Copper, Lead, and Zinc

In Pounds

	June, 1923	June, 1924
Copper		
Ores, concentrates, matte and regulus (copper content)	4,712	4,322
Copper and manufactures of	63,184,952	94,021,546
Refined, in ingots, bars, and other forms	55,732,291	84,428,285
Exported to		
Belgium	5,387,687	3,682,792
France	15,158,471	19,697,493
Germany	9,041,442	9,640,613
Italy	3,588,027	14,805,990
Netherlands	638,951	3,197,134
Spain	280,301	269,144
Sweden	1,740,081	1,471,468
United Kingdom	13,469,388	19,069,451
Canada	606,992	1,173,235
China	4,390,515	9,597,400
Japan	675,254	447,748
Other countries	755,182	1,375,817
Old and scrap	418,854	318,899
Composition metal, copper chief value	3,622	24,244
Pipes and tubes	203,727	297,955
Plates and sheets	470,612	424,426
Lead		
Pigs, bars, and other forms		
From domestic ore	1,124,055	1,199,866
From foreign ore	3,133,500	15,693,146
Exported to		
France	1,344,321	2,016,379
Germany	940,992	1,277,277
Netherlands	504,182	560,199
United Kingdom	728,374	9,244,181
Other Europe	56,084	1,680,563
Argentina	18,074	224,000
Brazil	488,854	414,483
Other countries	176,674	1,475,930
Other lead manufactures	516,728	1,359,024
Tin in bars, blocks, or pigs	190,286	129,309
Tin manufactures	1,107,130	844,200
Zinc		
Ore, concentrates, and dross	756,505	2,349,486
Spelter in slabs, blocks, and other forms	2,301,309	5,508,440
Exported to		
Belgium	.....	446,373
France	1,624,132	1,902,059
Germany	.....	1,289,052
United Kingdom	672,030	.....
Canada	1,728	70,412
Other countries	3,419	1,800,544
In sheets, strips, and other forms	980,546	572,546
Zinc dust	503,419	367,698
Other zinc manufactures	121,403	98,091

Metal Statistics

Monthly Average Prices of Metals

Silver

	New York		London		Sterling Exchange	
	1923	1924	1923	1924	1923	1924
January	65.668	63.447	31.928	33.549	465.053	425.524
February	64.313	64.359	30.875	33.565	468.631	430.457
March	67.556	63.957	32.310	33.483	469.269	428.769
April	66.855	64.139	32.346	33.065	465.220	434.788
May	67.043	65.524	32.611	33.870	462.252	435.716
June	64.861	66.690	31.611	34.758	461.132	431.675
July	63.015	67.159	30.942	34.509	458.025	436.649
August	62.793	.....	30.952	.....	455.714	.....
September	64.203	.....	31.698	.....	453.901	.....
October	63.649	.....	31.718	.....	452.024	.....
November	63.818	.....	32.774	.....	437.839	.....
December	64.705	.....	33.375	.....	435.500	.....
Year	64.873	.....	31.929	.....	457.047	.....

New York quotations, cents per ounce troy, 999 fine, foreign silver. London, pence per ounce, sterling silver, 925 fine.

Copper

	New York Electrolytic		London Standard		London Electrolytic	
	1923	1924	1923	1924	1923	1924
January	14.510	12.401	64.494	61.273	71.409	67.193
February	15.355	12.708	67.700	63.113	74.500	68.167
March	16.832	13.515	73.851	66.137	81.464	72.087
April	16.663	13.206	73.169	64.338	81.331	70.150
May	15.440	12.772	67.460	62.006	76.568	67.648
June	14.663	12.327	66.607	61.375	73.238	66.313
July	14.321	12.390	65.278	61.652	72.364	65.815
August	13.822	.....	64.034	.....	70.000	.....
September	13.323	.....	63.194	.....	68.275	.....
October	12.574	.....	60.614	.....	64.250	.....
November	12.727	.....	61.648	.....	66.477	.....
December	12.823	.....	62.035	.....	67.611	.....
Year	14.421	.....	65.840	.....	72.291	.....

New York quotations, cents per lb. London, pounds sterling per long ton.

Lead

	New York		St. Louis		London	
	1923	1924	1923	1924	1923	1924
January	7.633	7.972	7.571	8.002	27.119	31.528
February	8.050	8.554	8.093	8.643	28.519	34.589
March	8.252	9.013	8.254	8.891	28.815	37.161
April	8.101	8.263	7.996	7.932	26.956	32.819
May	7.306	7.269	7.085	6.973	25.614	29.426
June	7.146	7.020	6.852	6.848	25.429	32.138
July	6.237	7.117	6.126	6.886	24.188	32.916
August	6.582	.....	6.496	.....	24.222	.....
September	6.856	.....	6.700	.....	25.688	.....
October	6.831	.....	6.570	.....	27.815	.....
November	6.846	.....	6.582	.....	30.352	.....
December	7.369	.....	7.369	.....	31.042	.....
	7.267	.....	7.141	.....	27.147	.....

New York and St. Louis quotations, cents per lb. London, pounds sterling per long ton.

Tin

	New York 99%		New York Straits		London	
	1923	1924	1923	1924	1923	1924
January	37.986	48.250	39.173	48.750	181.852	246.790
February	40.693	52.772	42.011	53.272	190.513	272.399
March	46.569	54.370	48.569	54.870	219.607	277.429
April	44.280	49.457	45.810	49.957	213.081	250.863
May	42.346	43.611	43.135	44.111	203.097	218.511
June	40.375	42.265	40.957	42.765	191.798	219.219
July	37.970	45.75	38.490	46.25	181.188	233.332
August	38.841	.....	39.269	.....	186.795	.....
September	41.047	.....	41.547	.....	198.263	.....
October	41.322	.....	41.851	.....	203.957	.....
November	43.495	.....	43.995	.....	220.710	.....
December	46.662	.....	47.160	.....	235.007	.....
Year	41.799	.....	42.664	.....	202.148	.....

New York quotations, cents per lb. London, pounds sterling per long ton.

Zinc

	St. Louis		London	
	1923	1924	1923	1924
January	6.815	6.426	35.733	34.761
February	7.152	6.756	35.613	36.518
March	7.706	6.488	36.720	35.298
April	7.197	6.121	34.275	32.588
May	6.625	5.793	31.057	30.648
June	6.031	5.792	29.548	31.788
July	6.089	5.898	29.335	32.[illegible]3
August	6.325	.....	32.386	.....
September	6.438	.....	33.469	.....
October	6.293	.....	32.995	.....
November	6.347	.....	32.949	.....
December	6.260	.....	32.611	.....
Year	6.607	.....	33.058	.....

St. Louis quotations, cents per pound. London, pounds sterling per long ton.

Antimony, Quicksilver and Platinum

	Antimony (a) New York		Quicksilver (b) New York		Platinum (c) Refined New York		Platinum (c) Crude New York	
	1923	1924	1923	1924	1923	1924	1923	1924
January	6.884	10.279	72.731	59.500	112.462	122.115	115.500	
February	7.290	10.935	70.636	59.565	113.273	124.739	115.935	
March	8.885	11.442	70.808	64.269	110.846	121.692	113.231	
April	8.380	9.952	69.200	74.308	116.840	115.577	108.077	
May	7.477	8.755	68.000	76.962	115.007	115.731	112.192	
June	6.839	8.403	67.769	73.720	115.615	115.000	113.000	
July	7.097	8.477	66.980	72.173	116.000	118.231	113.865	
August	7.753	.....	65.212	.....	116.000	.....	.....	
September	7.633	.....	63.000	.....	116.000	.....	.....	
October	8.005	.....	61.769	.....	116.923	.....	.....	
November	9.156	.....	61.917	.....	124.479	.....	.....	
December	9.365	.....	60.000	.....	125.000	.....	.....	
Year	7.897	.....	66.502	.....	116.537	.....	.....	

(a) Antimony quotations in cents per lb. for ordinary brands. (b) Quicksilver in dollars per flask. (c) Platinum in dollars per ounce.

Pig Iron, Pittsburgh

	Bessemer		Basic		No. 2 Foundry	
	1923	1924	1923	1924	1923	1924
January	29.27	24.76	27.35	23.76	28.77	23.88
February	29.79	25.26	28.15	23.76	27.21	25.06
March	32.03	25.14	31.79	23.76	31.77	24.70
April	32.77	24.56	32.77	23.26	32.77	23.80
May	31.87	23.89	29.83	22.08	32.46	22.91
June	30.27	.....	28.34	.....	29.81	.....
July	28.47	.....	26.52	.....	27.47	.....
August	28.27	.....	26.77	.....	26.77	.....
September	28.26	.....	26.26	.....	26.72	.....
October	26.96	.....	25.01	.....	25.52	.....
November	24.79	.....	22.57	.....	23.60	.....
December	24.54	.....	22.62	.....	23.72	.....
Year	28.94	.....	27.33	.....	28.05	.....

In dollars per long ton.

Monthly Crude Copper Production

Domestic

	1924 March	April	May	June
Alaska shipments	9,388,162	6,538,827	6,375,469	6,314,241
Calumet & Arizona	2,084,000	3,330,000	3,332,000	2,346,000
Miami	5,311,000	5,163,000	5,314,000	5,439,000
New Cornelia	5,875,334	5,472,542	4,505,996	4,651,589
Old Dominion	2,100,000	2,071,000	2,000,000	1,715,000
Phelps Dodge	10,597,000	10,673,000	10,527,000	10,925,000
United Verde Extension	3,302,766	3,809,584	3,500,000	3,579,448
A.S. & R. & Tenn. Copper	14,000,000	17,000,000	17,500,000	17,000,000
Imports: Ore and concentrates, matte	9,479,348	11,577,799	16,882,662	.....
Partly from				
Chile	5,685,837	1,650,196	4,737,728	.....
Cuba	.....	1,792,000	1,848,000	.....
Canada	665,007	2,969,892	2,443,598	.....
Mexico	2,316,464	2,362,198	3,458,972	.....
Imports of black and blister, unrefined	47,332,796	31,688,505	36,563,022	.....
Partly from				
Chile	13,396,214	7,013,143	14,657,052	.....
Peru	12,413,463	2,428,445	4,302,661	.....
Africa	9,231,241	9,630,942	.....	.....
Mexico	5,808,720	7,082,030	6,286,999	.....
Imports of refined and old	8,718,668	10,318,440	8,970,467	.....

Foreign

Bolco, Mexico	1,454,198	976,815	1,801,485	1,375,201
Falcon Mines, Rhodesia	504,952	500,000	482,000	.....
Furukawa, Japan	3,416,954	.....	.....	.....
Cons. M. & S., Canada	.....	.....	400,000	.....
Granby Cons., Canada	3,977,000	3,229,788	2,892,869	3,076,770
Katanga, Africa	13,496,805	13,902,525	13,940,010	15,807,643
Mount Morgan, Aust.	440,000	682,000	800,000	.....
Mount Lyell, Aust.	1,322,000	484,000	1,600,000	.....
Phelps Dodge Mexican	3,047,000	3,175,000	2,547,000	2,783,000
Sumitomo, Japan	2,485,976	.....	2,394,132	.....

Comparative U. S. Copper Mine Production

	1921	1922	1923	1924
January	90,596,597	32,010,292	112,267,000	133,356,000
February	86,682,941	45,957,530	102,725,000	128,260,000
March	91,046,345	55,705,760	121,562,000	129,816,000
April	46,946,523	76,601,000	118,157,000	131,948,000
May	25,310,511	88,714,000	125,438,000	130,644,000
June	24,623,693	93,740,000	125,479,000	126,948,000
July	22,033,739	91,000,000	125,249,000	.....
August	23,248,398	101,188,000	131,088,000	.....
September	23,855,316	96,408,000	124,523,000	.....
October	23,231,572	103,273,000	132,481,000	.....
November	28,341,442	102,845,000	127,963,000	.....
December	26,629,137	103,003,000	129,354,000	.....

(a) Not available.

Company Reports

Tough-Oakes Burnside Gold Mines, Ltd.

Gold; Ontario

Tough-Oakes Burnside Gold Mines, Ltd., shows the following balance sheet as of March 31, 1924:

Balance Sheet

Assets

Current assets			
Cash in bank		$106,456.71	
Accounts receivable		1,636.95	
Stores and materials, at cost		1,663.95	
			$109,757.62
Buildings, plant and equipment at cost	$341,657.72		
Less provision for depreciation	206,821.35		
		$134,836.37	
Broken ore on dump and in stopes, at cost		2,332.78	
Current development, at cost		128,517.50	
Main shafts, at cost		23,857.83	
Mining properties, at cost		3,062,892.57	
			3,352,437.05
Deposit and deferred charges			4,380.67
			$3,466,575.34

Liabilities

Sundry accounts payable	$9,651.70

Surplus

Capital stock			
Authorized 5,000,000 shares, par $1	$5,000,000.00		
Issued 4,555,000 shares, per $1		$4,555,000.00	
Less deficit (before providing for exhaustion of mines)		1,098,076.36	
			3,456,923.64
			$3,466,575.34

During the fifteen months ended March 31, 1924, the working agreement with Kirkland Lake Proprietary (1919) Ltd., was continued until Aug. 31 last, when the company acquired five claims. Operations for the first eight months were confined to what is now the southwest part of the property, where several bodies of commercial ore had been previously discovered.

Since September last, development has been pushed ahead, with highly encouraging results on four levels, and veins have been opened up east of the diabase fault in territory not previously explored.

The main shaft has been sunk to a vertical depth of 930 ft.

From the results obtained in recent developments, the directors view the future of the property with every confidence and it is the intention to resume milling operations as soon as it is apparent that production can be continued and the property developed in accordance with the best mining practice. Meantime, the main shaft is being sunk an additional depth, and development work is being vigorously pushed ahead on the recently found orebodies.

United Verde Extension Mining Co.

The output of copper of the United Verde Extension Mining Co. for the second quarter of this year was:

	Pounds
April	3,809,584
May	3,140,036
June	3,579,448

The increase of silica in the general tenor of the first-class ore has caused slightly higher smelting costs, and some shipments of quartz ore are being made to the Hayden smelter, where siliceous stuff is needed. The increase for the period in review over ore developed in the mine above the 800 level is noteworthy, but no distinctively new orebodies have been discovered.

Copper is being sold ahead about as usual, and no plans contemplating changes in the company's regular output are being considered. The Clemenceau School having been completed, nothing but the construction of a few houses is in progress. The financial statement follows:

Cash on hand, July 1, 1924	$361,948.15
Liberty bonds, par value $3,363,950.00—market value	3,425,476.62
U. S. Treasury certificates	100,000.00

The board of directors, at a meeting on June 16, 1924, declared a dividend of 50c. per share, payable on Aug. 1, 1924, to stockholders of record at the close of business July 3, 1924.

United Eastern Mining Co.

United Eastern Mining shows a net income in 1923 of $563,983.48 after depletion and depreciation as follows:

Values recovered		
Gold	$1,958,612.09	
Silver	34,557.09	$1,993,169.18
Miscellaneous income		34,590.20
		$2,027,759.38
Mining	$368,031.61	
Development	44,502.13	
Milling	201,715.83	
Marketing	13,351.92	
Taxes	135,934.13	
Casualty reserve	10,855.39	
Superintendence	9,006.30	
Administrative and general	71,649.51	
Reserve for contingencies	33,000.00	
Miscellaneous	1,081.05	889,127.87
Income before providing for depletion and depreciation		$1,138,631.51
Depletion	$527,198.92	
Depreciation of plant	47,449.11	574,648.03
Net income		$563,983.48

Balance Sheet, Dec. 31, 1923

Assets

Capital assets		$110,003.07
Investments at cost		728,528.58
Working and current assets		850,148.09
Deferred charges		15,887.43
		$1,704,567.10

Liabilities

Capital stock		
Authorized and issued 1,500,000 shares, $1.00 each		$1,500,000.00
Less: In treasury 137,000 shares, $1.00 each		137,000.00
Outstanding 1,363,000 shares, $1.00 each		$1,363,000.00
Capital surplus:		
Balance Dec. 31, 1922	$351,373.26	
Distribution to stockholders in excess of net income for the year	253,816.52	97,556.74
Distribution to stockholders	$817,800.00	
Net income after providing for depletion and depreciation	563,983.48	
	$253,816.52	
Current liabilities		$244,010.36
		$1,704,567.10

Four quarterly dividends of 15c. per share were paid, a total of $817,800. Production amounted to 94,748 oz. of gold and 45,449½ oz. silver from 104,800 tons of ore. The average value of the ore was $19,896 per ton.

The Mond Nickel Co., Ltd.

The Mond Nickel Co. owns nickel and copper mines and smelting works in Ontario and nickel-refining works in Great Britain.

Share Capital: £3,400,000 in 500,000 7 per cent cumulative preference, 2,000,000 non-cumulative 7 per cent preference, and 900,000 ordinary shares of £1, full paid. Five per cent first-mortgage debenture stock, £375,000; 8 per cent debenture stock, £1,300,000.

Financial Statement

Year to Apr. 30	Net Profit (a) £	Directors' Fees, £	Income Tax, £	Pref. Dividend £	Ordinary Dividend £	Per Cent	Carried Forward £
1920	382,354	19,118	84,000	175,000	£157,500 t.f.	17½ t.f.	114,795
1921	222,630	11,131	110,000	175,000	45,000 t.f.	5 t.f.	
1922	299,042	14,952		175,000	67,500 t.f.	7½ t.f.	37,883
1923	307,774	15,400	.....	175,000	90,000 t.f.	10 t.f.	65,268
1924	276,458	13,823	.....	175,000	112,500	12½	40,403

(a) After deducting debenture interest.

The balance sheet is summarized below from the company's annual report to April 30, 1924.

Liabilities	1923 £	1924 £	Assets	1923 £	1924 £
Capital	5,075,000	5,075,000	Fixed assets	2,846,761	2,841,138
Creditors	846,637	980,473	Stores	172,640	223,342
Final divs.	155,000	155,000	Stocks	1,359,993	1,376,921
Depreciation Account	400,000	116,000	Investments	1,604,300	1,394,645
Reserve	345,000	345,000	Debtors	717,922	346,004
Carried forward	65,268	40,403	Cash	185,289	529,826
Total	6,886,905	6,711,876	Total	6,886,905	6,711,876

The company recently associated itself with the Central Mining & Investment Corporation, Ltd., in the formation of a syndicate called The Victoria Syndicate, Ltd., for the purpose of exploring the rich mineral deposits which undoubtedly existed in Canada.

The prospects of the American Nickel Corporation at Clearfield, of which the Mond company had acquired the whole of the share capital, were improved.

Mining Stocks

Week Ended August 2, 1924

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Alaska-Br. Col.	N. Y. Curb			*10		
Anaconda	New York	37⅛	36½	37	De.15, Ja.21, Q	0.75
Arcadian Consol.	Boston	2	1⅞	1⅞		
Ariz. Com'l.	Boston	11⅞	11	11⅛	Jy.19, Jy.31	0.50
Calaveras	N. Y. Curb			1½		
Calumet & Arizona	Boston	55	52½	53¾	Jn. 6, Ju. 23 Q	0.50
Cal. & Hecla (New)	Boston	18	17⅛	17⅛	My. 31, Jn. 16	0.50
Canario Copper	N. Y. Curb	4	3½	3½		
Cerro de Pasco	New York	48⅞	42½	45⅞	Jy. 17, Au. 1	1.00
Chile Copper	New York	32¼	31	31⅞	Se.3, Se.29, Q	0.62½
Chino	New York	22	20	22	Sept., 1920,	0.37½
Con. Coppermines	N. Y. Curb	3½	2¾	3		
Copper Range	Boston	29	27¼	28	May, 1923	1.00
Crystal Copper	Boston Curb	*90	*72	*00		
Davis-Daly	Boston	*50	*45	*45	Mar., 1920	0.25
East Butte	Boston	4¼	4⅛	4⅛	Dec., 1919	0.50
First National	Boston Curb	*38	*36	*38	Feb., 1919,	0.15
Franklin	Boston	*95	*70	*70		
Gadsden Copper	Boston Curb	*85	*85	*85		
Granby Consol.	New York	17⅞	17	17	May, 1919	1.25
Greene-Cananea	New York	17⅞	16	16	Nov., 1920	0.50
Hancock	Boston	1⅞	1½	1⅞		
Howe Sound	N. Y. Curb	3	2⅜	2⅞	Ap.1, Ap.15, Q	0.05
Inspiration Consol.	New York	27½	26	26⅜	De.20, Ja.7, Q	0.50
Iron Cap	Boston Curb	*3⅜	*3½	*3⅜	May, 1923	0.15
Isle Royale	Boston	18	16½	17	Se. 1, Se. 15,	0.50
Jerome Verde Dev.	N. Y. Curb	1	*81	1		
Jib Consol	N. Y. Curb	*86	*76	*77		
Kennecott	New York	47⅛	45⅝	46⅜	Jn.6, Jy. 1, Q	0.75
Keweenaw	Boston	1	1	1		
Lake Copper	Boston	2½	2½	2½		
Magma Copper	New York	35⅜	30½	35½	Jan., 1919	0.50
Mason Valley	N. Y. Curb	1⅞	1⅝	1⅞		
Mass Consolidated	Boston	1½	1	1	Nov., 1917	1.00
Miami Copper	New York	24	23⅛	24	Au.1, Au.15, Q	0.15
Mohawk	Boston	37⅛	34½	34⅛	Se. 22, Oc. 13,	1.00
Mother Lode Coa.	New York	8⅛	7⅞	8	Jn.13, Jn.30	0.37½
Nevada Consol.	New York	14½	13⅜	13⅜	Sept., 1920,	0.25
New Cornelia	Boston	22¼	21¾	22	Au.8, Au.25,	0.25
New Dominion	N. Y. Curb			2½		
North Butte	Boston	6	4⅜	4⅜	Oct., 1918,	0.25
Ohio Copper	N. Y. Curb	1 1/16	1	1 1/16		
Old Dominion	Boston	27¼	25½	25½	Dec., 1918	1.00
Phelps Dodge	Open Mar.	†103	†100		Jn.21, Jy.2 Q	1.00
Quincy	Boston	25¼	24	24	Mar., 1920	1.00
Ray Consolidated	New York	13⅛	11⅞	13⅛	Dec., 1920	0.25
Ray Hercules	N. Y. Curb	*15	*15	*15		
St. Mary's Min. Ld.	Boston	38⅛	36⅛	36⅛	Ap.22, My.20	3.00
Seneca Copper	New York	2⅛	2	2		
Shannon	Boston	*90	*75	*90	Nov., 1917	0.25
Shattuck Arizona	New York	8	7½	7½	Jan., 1920	0.25
Superior & Boston	Boston	1½	1	1½		
Tenn. C. & C. cfs.	New York	9½	8⅜	9⅛	De.31, Ja.15, Q	0.25
United Verde Ex	N. Y. Curb	30½	26	28½	Jy.3, Au.1	0.50
Utah Copper	New York	81⅜	79⅛	79⅜	Jn.13, Jn.30,	1.00
Utah Metal & T.	Boston	70	40	40	Dec., 1917	0.30
Victoria	Boston	*75	*75	*75		
Walker Mining	N. Y. Curb	3⅜	3⅛	3 3/16		
Winona	Boston	*50	*50	*50		
NICKEL-COPPER						
Internat. Nickel	New York	19¼	17⅜	19¼	Jy.17, Au.1, Q	1.50
Internat. Nickel pfd.	New York			88	Jy.17, Au.1, Q	1.50
LEAD						
Carnegie Lead & Zinc	Pittsburgh	4	3	3¼		
National Lead	New York	150¾	144	148	Se.12, Se.30, Q	2.00
National Lead pfd.	New York	115½	115	115	Au. 22, Se. 15, Q	1.75
St. Joseph Lead	New York	30⅛	28⅜	29⅛	Se. 9, Se.20	0.50
ZINC						
Am. Z. L. & S.	New York	9⅛	8½	9	May, 1920	1.00
Am. Z. L. & S. pfd.	New York	30	29	29	Nov., 1920	1.50
Butte C. & Z.	New York	5⅜	5⅜	5⅜	Mar., 1923	0.50
Butte & Superior	New York	18⅛	17⅜	17⅞	Je.15, Je. 30, Q	0.50
Callahan Zn-Ld.	New York	4⅛	3⅜	3⅞	Dec., 1920	0.50
New Jersey Zn.	N. Y. Curb	147⅛	144¾	147⅛	May 10, 1924	2.00
United Zinc	N. Y. Curb	*25	*25	*25		
Yellow Pine	Los Angeles	61	61	61	June, 1924	0.04
SILVER						
Alvarado	N. Y. Curb	1	1	1		
Beaver Consol.	Toronto	*14	*14	*14	May, 1920	0.03
Castle-Trethewey	Toronto	*78	*72½	*78		
Coniagas	Toronto	1.40	1.40	1.40	Ap.20, My.1	0.02½
Crown Reserve	Toronto	*55	*53½	*55	Jan., 1917	0.05
Keeley	Toronto	2.26	2.24	2.24		
Kerr Lake	N. Y. Curb	2	1⅞	2	Ap.1, Ap.15, Q	0.12
La Rose	Toronto	*10	*9½	*10	Apr., 1922	0.10½
Lorrain Trout Lake	Toronto	1.37	1.35	1.35		
McKinley-Dar.-Sav.	Toronto	*11	*11	*11	Oct., 1920	0.03
Mining Corp. Can.	Toronto	2.45	2.40	2.40	Sept., 1919	0.12½
Nipissing	N. Y. Curb	6⅜	5⅛	6	Jn.30, Jy.21, Q	0.15
Ontario Silver	New York			6¼	Jan., 1919	0.50
Temiskaming	Toronto	*19	*18½	*19	Jan., 1920	0.40
GOLD						
Alaska Gold	New York	⅛	⅛	⅛		
Alaska Juneau	New York	1⅛	1⅛	1⅛		
Argonaut	Toronto			*38½		

Stock	Exch.	High	Low	Last		Last Div.
Carson Hill	Boston	1⅛	1	1		
Cresson Consol. G.	N. Y. Curb	3⅛	3⅛	3⅛	Jn.30, Jy.10, Q	0.10
Dome Mines	New York	15⅞	15	15½	Jn.26, Jy.21, Q	0.50
Golden Cycle	Colo. Springs			1.30	My.31, Jn.10 Q	0.03
Hollinger Consol.	Toronto	13.90	13.90	13.90	Jy.24, Au.11, M	0.05
Homestake Mining	New York	42	42	42	Jn.20, Jy.25,	0.50
Kirkland Lake	Toronto	*19½	*19½	*19½		
Lake Shore	Toronto	3.92	3.85	3.92	Se.1, Se.15, Q	0.05
McIntyre-Porcupine	New York	15⅜	15⅛	15⅜	Au. 1, Se. 1,	0.25
Newray	Toronto	*22	*20½	*20½		
Portland	Colo. Springs			51	Oct., 1920	0.01
Teck-Hughes	Toronto	1.20	1.16	1.20		
Tom Reed	Los Angeles	32½	30½	30½	Dec., '1919	0.02
Tough-Oakes	Toronto	*59	*56½	*58		
United Eastern	New York	*48	*42	*45	Jy.18, Jy.31, Q	0.05
Vipond Cons.	Toronto	1.01	1.01	1.01		
Wright-Hargreaves	Toronto	3.70	3.60	3.65	Jn.16, Jy. 1, Q	0.02½
GOLD AND SILVER						
Black Oak	N. Y. Curb	*93	*89	*93		
Con. Cortez	N. Y. Curb	*19	*15	*19		
Con. Virginia	San Francisco	3½	3½	3½		
Continental Mines	N. Y. Curb	2½	2½	2½		
Dolores Esperanza	N. Y. Curb	*60	*50	*55	Jy. 1, Jy. 10 Q	0.05
Premier Gold	N. Y. Curb	2⅛	2	1⅛	Jn.19, Jy.2	0.08
Tonopah Belmont	N. Y. Curb	*61	*55	*61	Apr., 1923	0.05
Tonopah Divide	N. Y. Curb	*27	*25	*27	Se.22, Oc. 10	0.10
Tonopah Extension	N. Y. Curb	2⅛	2	2⅛	Jn. 10, Jy. 1	0.05
Tonopah Mining	N. Y. Curb	2 1/16	2	2	Ap. 6, Ap. 21	0.07½
Unity Gold	N. Y. Curb	1	1	1		
West End Consol.	N. Y. Curb	*55	*53	*55	Mar., 1923	0.05
Yukon Gold	N. Y. Curb	*60	*50	*50	June, 1918	0.02
SILVER-LEAD						
Ahumada	Boston Curb	6	5⅜	6	Jn.16, Jy. 2, X	0.15
Bingham Mines	Boston	16½	16	16	Sept., 1919	0.25
Cardiff M. & M.	Salt Lake			*74	Dec., 1920	0.15
Chief Consol.	Boston Curb	2⅛	2⅛	2⅛	Ap 19, My. 1, Q	0.10
Columbus Rexall	Salt Lake	15	16	16	Aug., 1920	0.03
Consol. M. & S.	Montreal	39½	38½	38½	Jn.30, Jy.15	0.75
Daly Mining	Salt Lake	2.25	2.25	2.25	July, 1920	0.10
Erupcion	Boston Curb	2⅛	2⅛	2⅛	Jn. 16, Jy.2, X	0.15
Federal M. & S.	New York			10½	Jan., 1909	1.50
Federal M. & S. pfd.	New York	47½	45½	47	My.26, Jn.15, Q.	1.75
Florence Silver	Spokane	9.25	8.75	9.25	Apr., 1919, QX	0.01
Hecla Mining	N. Y. Curb	9	8½	9	My.15, Jn.15,	0.25
Iron Blossom Con.	N. Y. Curb			*20	Oct., 1923	0.02
Marsh Mines	N. Y. Curb			*5	June, 1921	0.02½
Park City	Salt Lake	4.00	4.00	4.00	Jn.14, Jy.1,	0.15
Park Utah	N. Y. Curb			3½	Mc.15, Ap.1	0.15
Prince Consol.	Salt Lake	*5½	*5½	*5½	Nov., 1917	0.02
Silver King	N. Y. Curb	*75	*75	*75	Jn.20, Jy.1,	0.15
Silversmith	Spokane	*32½	*28½	*32½	Jy.1, Jy. 10,	0.01
Tamarack-Custer	Spokane	1.46	1.43	1.45	Jn.25, Jn.30,	0.02
Tintic Standard	Salt Lake	5.55	5.25	5.55	Jy.28, '24, X	0.25
Utah-Apex	Boston	2⅞	2½	2⅝	June, 1923,	0.50
IRON						
Bethlehem Steel	New York	44½	42⅜	44½	Jn.1, Jy.1, Q	1.25
Char. Iron	Detroit	50	47	50		
Char. Iron pfd.	Detroit			3		
Colorado Fuel & Iron	New York	50½	44½	50½	Au.11, Au. 25 Q	2.00
Col. Fuel & Iron pfd.	New York			102	Feb., 1923	2.00
Gt. North'n Iron Ore	New York	31½	30	31½	De.10, De.27	2.00
Inland Steel	N. Y. Curb			46	Au.15, Se.1 Q	0.62½
Mesabi Iron	N. Y. Curb			2⅜		
Replogle Steel	New York	13½	11½	12½		
Republic I. & S.	New York	49⅜	47⅛	49	May, 1921	1.50
Republic I. & S. pfd.	New York	87½	87	87	Se.15, Oc.1, Q	1.75
Sloss-Sheffield S. & I.	New York	67½	62⅛	66½	Jn.6, Jn.20, Q	1.50
Sloss-Shef. S. & I. pfd.	New York	87	86	87	Jn.18, Jy.2, Q	1.75
U. S. Steel	New York	109	101½	108⅜	Se.1, Se.29 QX	1.75
U. S. Steel pfd.	New York	123	122½	123	Au. 5, Au. 30 Q	1.75
Virginia I. C. & C.	New York	37⅛	37⅛	37⅛	De.15, Ja. 2	1.50
Virginia I.C.&C.pfd.	New York			71	Jn.17, Jy.1	2.50
VANADIUM						
Vanadium Corp.	New York	25⅜	23⅛	24½	Jan., 1921	1.00
ARSENIC						
Western Utah Copper	N. Y. Curb	*20	*17	*17		
ASBESTOS						
Asbestos Corp.	Montreal			24⅜	Se.29, Oc.15 Q	1.00
Asbestos Corp. pfd.	Montreal			59	Jy.1, Jy.16, Q	1.50
SULPHUR						
Freeport Texas	New York	9⅞	9	9⅛	Nov., 1919,	1.00
Texas Gulf	New York	74⅜	72	73	My.31, Jn.14 QX	1.75
PLATINUM						
So. Am. Gold & P.	N. Y. Curb	3⅛	3⅛	3⅛		
MINING, SMELTING AND REFINING						
Amer. Metal	New York	46	44½	46	Au. 18, Se. 2 Q	0.75
Amer. Metal pfd.	New York	112	112	112	Au.20, Se. 2, Q	1.75
Amer. Sm. & Ref.	New York	70⅜	69	69⅜	Jy.11, Au. 1, Q	1.25
Amer. Sm. & Ref. pfd.	New York	103½	103½	103½	Jy.11, Au. 1.	1.25
U. S. Sm. R. & M.	New York	31⅜	29½	31½	Jan., 1921,	0.50
U. S. Sm. R. & M. pfd.	New York	45½	45	45	Jy.7, Jy.15 Q	0.87½

* Cents per share † Bid or asked. Q, Quarterly. SA, Semi-annually. M, Monthly. K, Irregular. I, Initial. X, Includes extra. The first date given is that of the closing of the books; the second that of the payment of the dividend.

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